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THE COMPTROLLER AND THE COMPUTER

A Presentation by

COLONEL ROBERT G. DAVIS, COMPTROLLER, FORT BENJAMIN HARRISON AND FINANCE CENTER, U. S. ARMY TO THE INDIANAPOLIS CHAPTER OF THE INSTITUTE OF INTERNAL AUDITORS DINNER MEETING

ABOUT THE AUTHOR

CURRENT ASSIGNMENT

Colonel Robert G. Davis, Comptroller, Fort Benjamin Harrison and the Finance Center, was assigned here April 20, 1959. Colonel Davis comes to the Finance Center from Headquarters of Third United States Army, Fort McPherson, Georgia, where he served as Staff Finance and Accounting Officer under Lt. General Clark L. Ruffner. It was while on that assignment that Colonel Davis supervised the installation of a variety of accounting systems and procedures such as Army Stock Fund, Army Command Management System, Integrated Accounting, and Electrical Machine Accounting which were implemented into nine military installations in the Third Army Area.

NATIVE OF SEATTLE—EDUCATION

Born in Seattle, Washington, in 1908, Colonel Davis holds a Bachelor of Business Administration degree from the University of Washington, Class of '32. Following his graduation, he was employed by the B. F. Goodrich Company for ten years as an accountant, salesman, and finally as Credit and Operating Manager of the Salt Lake City Region.

MILITARY EXPERIENCE

Colonel Davis entered active duty with the Army as a Second Lieutenant of Infantry in 1942 and served briefly as Assistant Professor of Military Science and Tactics at the University of Oregon. From 1942 to 1943, he served with the Department of Army, Washington, D.C., auditing the records of numerous colleges and universities on the east coast and later the west coast of the United States under the Army Specialized Training Program. In 1945, following a course at the Industrial War College, Colonel Davis was assigned to auditing industrial and aircraft plants on the west coast until contract termination in December 1946. The Army Commendation medal has been presented to him twice for outstanding performance of duty.

RETURN TO CIVILIAN LIFE

He left the Army in December 1946 and became affiliated with the Crown Zellerbach Corporation in San Francisco, California, as an Assistant Comptroller, supervising accounting systems and internal audit procedures through the home office, 12 large regional sales offices, and 6 affiliate companies of the Crown Zellerbach Corporation.

INSTRUCTOR OF ACCOUNTING

Colonel Davis accepted a Regular Army commission and re-entered the Army in late 1947. He has since served as Instructor of Accounting at St. Louis University, Instructor at the Finance School, both basic and advanced courses of accounting and auditing, and two years in Alaska as Chief of the Audit Division of that large command. He served as Assistant Chief, Army Audit Agency, Washington, D.C., in 1952 and 1953, and as Director of the New York Region of the Army Audit Agency, New York City, during 1953 through 1955.

HOME IS ANAHEIM, CALIFORNIA

Colonel Davis makes his legal home in Anaheim, California. He is a full member of American Accounting Association, he is a licensed Public Accountant with current status in the State of California snce 1946. He formerly operated his own Public Accounting practice in San Francisco and Santa Monica, California. He is a charter member of the Society of Public Accountants of California. He is also a Life Member of the Alumni-Association of the University of Washington and The Kappa Sigma Fraternity.

I was pleased when Wendell Fenn assigned me the job of talking to you about *"The Comptroller and The Computer."* I was pleased because I have some positive views on the subject. Based upon twelve years in comptroller organi-

zations in industry and sixteen years in various assignments with the Army, I believe that the computer has opened up a new era in data processing. I think computer planning and operations are comptroller functions offering a tremendous challenge to the comptroller profession.

What impact do computers have on large industrial and governmental organizations? Here is what Mr. Ralph J. Cordiner of General Electric Corporation had to say not too long ago, and I quote: "When the history of our age is written, I think it will record three profoundly important technological developments:

"Nuclear energy, which tremendously increases the amount of *energy* available to do the world's work;

"Automation, which greatly increases man's ability to use *tools*:

"And computers, which multiply man's ability to do *mental work*.

"Some of our engineers believe that of these three, the computer will bring the greatest benefit to man."

Actually, just a short time ago, in 1954 to be exact, at Louisville, Kentucky, in the General Electric Appliance Park, a new industrial revolution was started. It began with fanfare and great expectations when the first large-scale electronic computer planned exclusively for business use was installed. Since that time, the revolution has become most plexing and disgruntled. None the less, it is an inevitable revolution in data processing.

Comptrollers as a group control many computer operations. This is partly because accounting had such a big part in early computer usage and partly because, in theory, the comptroller is one department that cuts across organizational lines of the whole company. However, there is a serious debate over whether comptrollers should have control of the computer operation. Some people say that the comptroller operates from rigid and well-defined traditional concepts, and that these things need a new approach. Also, comptrollers are as guilty as anyone of empire building and protection of the old systems.

Unfortunately, comptrollers vary in different companies from mistitled head bookkeepers to powerful and trusted advisors to the chief executive. Those falling in the role of trusted advisors to the chief executive have a big role to play in the development of the full potential that computers have made possible in this new industrial revolution.

On the other hand, I am concerned about the increasing number of articles appearing in professional magazines which imply that the comptroller profession is not big enough to meet this challenge. In many cases, however, the criticism of the comptroller is valid because we have comptrollers who have given undue priority to placing financial and accounting operations on the computer but neglected the broader needs of the company for automation of production control and other functions related to manufacturing in the company.

I am proud to say this is not true at the Finance Center. The applications on our IBM 650 Computer and those planned for the Honeywell 800 are mission-type applications such as soldiers' deposits, military pay voucher processing, and allotment operations. In our case, these applications could be compared with production control and related manufacturing processes in a typical business. In other words, we took full advantage of our mission applications and did not give priority to local accounting operations which are a comptroller responsibility. In fact, after studying local civilian pay as a computer application, we decided it should not be placed on the computer because we could not see benefits commensurate with the effort and cost involved.

I am also pleased to inform you that the comptroller organization has been the action office from the beginning on our computer efforts.

We have been actively studying automatic data processing systems at the Finance Center since June of 1954. Some of our major reorganizations and systems changes since that time have been engineered to dovetail with our ultimate plans for automatic data processing.

When we started our first study in 1954, during the very early stages of the efforts to place business-type operations on computers, the romance of electronic speeds and the "cure-all-ills" theme were running high. Our feasibility study showed that a substantial savings could be gained by utilizing a large computer. Despite our enthusiasm, however, as a part of the original study, we visited several government and commercial activities that had installed the first

computers for business applications. As late as 1956 when we concluded our initial study, very few of these installations were on an actual paying basis even though some had large computers installed for many months. We could not afford to take any chances with such a sensitive mission as allotment "bread and butter" checks to the dependents of military personnel. Neither did we feel that we could afford to pay thirty to forty-thousand taxpayer dollars per month for a year or two years while converting to a computer operation. Thus, in 1956 we established this position:

(1) Installation of a large-scale computer should be delayed and a more gradual approach to ADP should be adopted by the Finance Center.

(2) We should make a detailed study of medium-sized computers.

(3) The soldiers' deposits function, being less sensitive than the allotment function, should be selected for consideration in the medium-sized computer study.

After that study, in 1957, it was decided that we should install a medium-sized computer which would be used as an interim step in the later selection and installation of a large-scale computer which would permit maximum savings to be realized.

The IBM 650 system was installed at the Finance Center in January 1958. Since it was installed, it has been in operation for two or three shifts on a continuous basis. It has given us excellent service. We are now saving approximately one hundred thousand dollars annually, compared to cost of operation before adopting the 650 system.

After successful operation of the 650 system we formed a study team in September 1958 to select the best large-scale computer for Finance Center use. This study was completed in September of 1959 with the recommendation that the Honeywell 800 computer be installed for the Finance Center. As you saw this afternoon, Honeywell is now in process of installing their large-scale computer in our building. We hope to be operational within the next two months on several applications. Based on our current estimates, after we are fully operational with all planned applications for the H-800 system, we estimate an additional savings of approximately three hundred forty thousand dollars annually.

We are proud of the progress made with electronic data processing at the Finance Center. We feel we have learned a great deal about electronic computers. Perhaps the most important lesson is that much hard work and long lead time is required to do the detailed systems work and programming required before any application can be successfully accomplished on the computer.

I would also like to assure you that we are not satisfied and complacent with the installation of a large-scale computer system. A computer in itself is certainly not the end of our required changes for the most efficient and economical operation. For example, when we examine keypunch cost we find the Finance Center is spending well over one million dollars annually on this function. We are presently considering a couple of avenues to reduce this cost. One avenue which we are enthusiastic about is the newly developed character scanning equipment. We hope in the not too distant future we can have a machine which will recognize the characters on type-written documents and automatically prepare magnetic tape input to our computer without going through the keypunch process.

Gentlemen, for a few moments I would like to be specific and discuss one of the fundamentals of modern auditing procedures, "Internal Control" as it pertains to the computer. Superficially, it may appear that the need for internal control may be greatly reduced through use of the computer. Electronic equipment functions with an accuracy far greater than other equipment or human being can ever hope to achieve. Someone has estimated that the chance of a machine error is one in several billion. The risk of error seems fantastically small; yet in every successful installation a great deal of attention is directed to control. *Why?* Experience has shown there are several good reasons.

First, the above mentioned error ratio refers only to the *undetected* error.

Most errors are detected within the system by the parity check, digit count, or some internal control incorporated within the circuitry of the computer. Some errors cannot be found in this manner. Controls are required to recognize them and initiate corrective action.

Second, errors *do* occur with sufficient frequency within the computer, so that they must be adequately guarded against.

Third, the central unit of the EDP system has a higher degree of reliability than the vari-

ous input and output devices such as card readers, paper tape readers, magnetic tape readers, and various output devices. These still create concern because of the vast volumes of work they process.

Finally, and most important, we must prevent, through control, "Gigo" (Garbage In, Garbage Out). The machines operate equally well with incorrect data but the results are not those desired. Thus it becomes necessary to build into the system a series of controls to check the accuracy of the operation, inspite of the basic reliability of the equipment. One interesting aspect of controls is that, once the need for control is recognized, a tendency to *"overcontrol"* develops. One company in its initial program checked every item that passed through the computer, whether the item was active or not. This meant that, instead of processing only the active one-tenth of the file, the entire file was processed. This was an unnecessary precaution. The machine running time for this work was reduced by a factor of seven when these extra controls were removed.

How can we ascertain the proper control limits? Controls should be added *when* and *only when* they serve a useful purpose and do not require excessive time to function properly. Some programmers are not familiar with control concepts and therefore should consult with the accounting policy or internal auditors on this matter.

There should be adequate control totals over incoming data, including card counts, when punch cards are used as input, and item counts when paper tape is used. These controls can be established by a count of initial documents and by developing totals of money or hours. Card or paper tape punching should be checked by verifying punching and spot checked against source documents on a random sample basis.

Within the computer itself, item counts can be made to see that no items are lost in reading from the magnetic tape or that no punched cards have been lost during conversion. Also, the computer should be programmed to verify the control totals which were established outside the system. For some applications, such as payroll, checking for "reasonableness" can be very valuable. In this type control, upper and lower limits are established beyond which the gross salary should not go. If the amount falls outside these limits, an effort is made to find the cause.

Special controls are necessary when magnetic tape is used as input and output. Tapes should be labeled internally as well as externally. A full description of the information on the tape should be recorded on the physical tape itself as well as on the outside reel label. Each time a tape is to be used by the computer, the identification is examined internally to determine that the correct tape was mounted. It would be disastrous if incorrect tape were mounted and read, or destroyed by writing upon it. Most computers have a lockout device on the tape handled which will prevent writing on a tape by accident when the tape is only to be used for reading purposes. This device should be used.

A control which is desirable when magnetic tape is used is to establish an item count when the tape is written upon and check this count in subsequent reading operations.

Most companies maintain "Back-up" tapes for all their master files, so that the master files could be duplicated if necessary. These tapes are generally kept in a safe place away from the computing center.

One aspect of control many forget is that of preventing the possibility of unauthorized changes in programs or data on magnetic tapes. We should consider keeping the tapes under lock and key with the sole responsibility for them in the hands of a tape librarian. A record copy of what was changed through console type-in should be on file for review by the EDP supervisor and the internal auditors.

Most of the preceding has involved the controls to assure that data "entrusted" to the EDP system will be accurately handled; however, of equal and probably even greater significance are the procedures and controls established to provide assurance (1) the data which the EDP system is asked to process accurately, fairly, and honestly represent all the business transactions which took place, (2) these transactions are processed once and only once, (3) rejected items are corrected and returned for processing.

Primarily, here, reliance continues to be placed on those accounting and internal controls which have been developed over the years, such as proper authorizations, protection of documents, division of duties and responsibility, and proper internal and external audits. Reliance continues to be placed on controls established outside the computer area.

The requirements for an audit trail do not exceed those of our financial divisions. An auditor will normally wish to be able to follow a transaction through from its source to its completion. Virtually all comptrollers desire to be able to do the same. We find it desirable and essential to be able to reconstruct portions or all of the work passing through the EDP system and having a method to identify the initial documents from which a finished report is developed. And we are, of course, vitally concerned with good internal control. In addition, both external and internal auditors will and should insist that the elctronic system meets all the requirements of good internal control.

That covers the highlights of the computer efforts at the Finance Center. Now I would like to conclude my remarks back on the theme of the comptroller and the computer. I believe *if* the comptroller profession is aggressive to learn and exploit this new potential and is willing to serve others, we can align computer planning and operational control with the comptroller profession. I hope it will become recognized as such along with accounting, internal auditing, budgeting, and the other recognized comptroller functions.

This requires vision of the potential for electronic management in the vast areas of processing data, administrative and manufacturing control, and decision making. In this picture of the future, we must visualize the electronic center as the very heart of any big business. As new orders feed in, the center can automatically determine, order, and allocate the material and labor requirements, schedule production and delivery, send out bills and make payments, and supply compact, accurate, and immediate reports to top management all in one continuous flow of a completely integrated management system.

How soon will all this happen? This is a good question. Theoretically, it could be done now. The equipment capability is here with the computers now available from several manufacturers. In more practical terms, however, it probably won't happen extensively for another decade, and for it to happen then requires aggressive action by those individuals held responsible for computer planning and operations. The greatest barrier is the human barrier. It requires selling top management on new concepts and the hard work required to develop and program the systems required to implement these new concepts. It requires the break-down of departmental walls that in some cases have existed for a half century.

In conclusion, I hope you will join me in accepting the challenge that the computer is a powerful new tool that the comptroller profession should exploit fully. Gentlemen, it is always a pleasure and a privilege to have a professional group such as yours visit our organization. It is our privilege to have you take a look at us. Thanks for coming. I hope you have enjoyed your visit this afternoon and evening and that you will come see us again.

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IMPACT OF AUTOMATION ON FINANCIAL MANAGEMENT ACCOUNTING

An Address to the American Socitey of Military Comptrollers, San Antonio, Texas by Mr. Lowell D. Farmer

ABOUT THE AUTHOR:

Mr. Farmer is the Assistant Comptroller for Systems and Procedures, Headquarters, Air Training Command. He has spent the last 20 years in Comptrollership. He holds a BA Degree in Business Administration from McKendree College, Lebanon, Illinois, and a MBA Degree in Business Administration from St. Louis University. He is a special lecturer in Management in the Graduate School of Business Administration at St. Mary's University in San Antonio, Texas.

One of the most fascinating characteristics of human society is the inevitability of progress.

Throughout the history of the race, although periods occured during which nothing apparent was accomplished, in the long run we have obeyed the dictates of the natural law and, step by faltering step, have made progress.

So it has been with the art of financial management. No one knows when the first man started to keep accounts, or predict requirements, or allocate scarce resources in a manner best calculated to insure survival of himself, his family, or his tribe. But somewhere, back in the annals of unrecorded history, many thousands of years ago, the concepts and procedures we now use in financial management had their beginning. Through these many years these concepts have evolved, until today we have amassed a sufficient body of knowledge to perform what we consider to be a very respectable job in directing the financial affairs of an organization.

Today we are on the threshold of a sudden surge in the development of improved financial techniques and procedures. This surge is tied directly to the advent of electronic computers. These events are bearing down on us with such speed, that the developments which will be achieved in the span of the next few years will probably dwarf those accomplished in the last century. In far too many cases, our people are reacting with mortal fear and panic, as if a terrible monster had been unleashed by the devils of darkness to destroy them. If they could only see that we are on the verge of a long step forward in the growth of the techniques of our field!

I consider it a great honor to have been given the opportunity this evening to discuss the subject of the effect of electronic data processing systems on financial management. It is one which has consumed much of my thought and efforts for the past several years. It is one which we must understand and promote, if we are to maintain our traditional role as servants to management.

In 1950 only a few computers, probably less than a dozen, were in operation. Today, 10 years later, many hundreds are installed. Information available indicates that now, at the beginning of 1961, one company alone has back orders for over 4,000 computers. This indicates the phenomenal growth that has occurred in the industry. More significantly to us, it indicates that managements everywhere are convinced that the computer will go a long way toward solving the problem of the skyrocketing administrative costs they have experienced in the last 20 years. Management is not only optimistic, but enthusiastic and impatient, even in the face of the fact that some EDP installations presently in existance are only moderately successful.

The past ten years has been, in reality, a period of almost total experimentation. Ten years ago very few people had any real understanding of computer potential. Many starts and stops, errors, wash backs and wash outs were experienced. The application of Murphy's law had almost unanimous application. What could go wrong went wrong in most instances. Many of the resultant systems which are extoled as radical data revolutions are in reality nothing more than old, antiquated systems warmed over on a new range.

Out of this chaos, however, concepts have emerged which have vital importance to us as financial officers. Some of them stand out crystal clear, some have only recently been recognized and their ultimate value has not been determined.

One of these which in the future will have very great impact on financial management procedures is the concept of "integration."

With few exceptions, EDP applications existing today are oriented to the functional organization; (*Chart* 1) the organization that is installed for management purposes, to facilitate the achievement of an objective or accomplishment of a mission. It is established around the four famous organizational principles — (1) Unity of Command, (2) Homogeneous Assignment, (3) Delegation of Authority, and (4) Span of Control. We find applications in Personnel, Materiel, Operations, Comptroller, etc., all oriented to needs of the supervisors of these segments of the management organization. Almost without exception these systems presume that data processed is the exclusive property of the originator.

In the last few years we have come to realize that there exists, in addition to the functional organization, a data organization which is far more complex in its interrelationship. (*Chart* 2). Management functions are data sources and data consumers only, and are not entities around which successful data systems are built. Every bit of data created has one or more primary and one or more secondary users. To automate the processing of a bit of data for *only* one user as we have in the past, is not only squandering dollars and reducing management advantage, but may create imbalances in the system which could be disastrous.

We must address ourselves to the data organization, rather than the functional, if we are to achieve a successful automated system. The "integrated data processing" concept achieves this goal. It views the job from the viewpoint of the total need, and requires that data processed be oriented to the needs of all primary and secondary users.

The second concept which will have very important effect on the financial management techniques is "source data automation."

Most currently automated data systems employ what I like to call the "last mile technique." (*Chart* 3). A document is prepared manually, flows through a maze of offices and is the subject of several postings, verifications, and other actions, and finally (usually at the last step of the process) is key punched and included in automated records.

Frankly, this system provides little if any operational or economical advantage. We find that we have achieved nothing except to provide a means of rapid manipulation of historical data. Decisions have already been made and errors committed before mechanization takes place.

The effect is the same as if enroute to Baltimore, Maryland from San Antonio, Texas we *walk* to Washington, D.C., then take a jet airliner to our destination. All our energy and resources are consumed in reaching Washington. Little is left to conserve during the last mile of the journey.

To achieve maximum operational and economic advantage we must automate the total system. Only by this means can we replace manual registers and records by machined products. Only by this means can we eliminate the host of errors which inevitably creep into multiple manual records due to our human frailty.

Many good equipments now on the market make it possible to create punch card or paper tape input as a by-product of typing special orders, purchase orders, and other documents. Many of these documents can be printed on punched cards as treasury checks, transportation requests, and AF leave orders are today. This technique makes it possible to use the document, per se, as the input medium. An attitude for progress, plus a little imagination will make this concept pay dividends never before imagined. (*Chart* 4). We will board the jet aircraft in San Antonio, and conserve our energy resources for other pursuits in Baltimore, rather than expend them foolishly enroute.

The third concept which will have great effect on the financial management process is the *data processing center concept.*

This concept deals with calculated capacities and economics. The economies of scale come into play. Equipments on the market today have the capacity to receive, and process, tremendous volumes of data. In many cases, in an organization spread over a wide geographical area, the data load at one location is not sufficient to pay for a computer installation. Or, if each location has a sizeable data load, it may be more economical to establish a data processing center supported by a communication net, than to establish individual computers at all dispersed sites. The economical advantage of the 2nd or 3rd shift, at a fraction of the cost of the prime shift, or the advantage of one large computer vs. several small installations comes into play.

This concept requires some reconciliation with the decentralized management principle. However, careful examination will reveal a very sharp distinction between centralized management and centralized data processing. The feed back of more accurate and timely management information, personalized to the needs of the manager at the operating location, leaves the decentralized management principle inviolate.

In a report released in September 1958 by the Rand Corporation of a special study made for the Air Force, it was pointed out that central data processing centers were the best means of achieving maximum advantage from EDP. (*Charts* 5 *and* 6). Two of the centralized methods specifically recommended in this report are by region and by command.

Centralized data processing is not a pipe dream. Many central systems exist today. Examples are: the Veterans' Administration system at Hines, Illinois; the Old Age Survivors' Insurance system at Baltimore, Maryland; the Sylvania Corporation system at Camallus, New York; and the Logistics Management system for Ballistic Missiles at Norton Air Force Base, California.

It is becoming more and more apparent that these three concepts—integrated data processing, source data automation, and central data processing centers will force radical changes in our financial management procedures. This fact is the subject of much discussion and research at the present time. At a faculty meeting in the School of Business, St. Mary's University, last December the principal speaker, Dr. Paul Grambsch, Dean of the School of Business at the University of Minnesota asked this question, "Gentlemen, within the next few years the principles of accounting as you know them today, will disappear inside a computer; what are you doing to prepare your students for this development?"

I think that Dean Grambsch's statement may have been a little too broad. The principles of accounting are sound, and most of them will survive. But the methods and techniques used will be so radically changed as to be unrecognizable. Let's take a look at a schematic which may help us visualize what the effect might be. (*Chart* 7).

The hub of this system is the central processing agency which houses a computer and necessary auxiliary equipments including tape and random access equipment, card and paper tape to magnetic tape connverter, and high speed printer.

The first input into the system will be the operating budget, which, when recorded on magnetic tape, becomes the yardstick against which progress is measured.

As resources are consumed, orders are placed, bills become due, or other action is taken, input data is created as a by-product of the preparation of basic source documents. This data, entering the system in the form of punched cards or paper tape, will be used to update magnetic tape allocation, expense, payroll, general ledger, and other records. At the end of the reporting cycle, (daily, weekly, or monthly) status reports will be rendered to operating agencies and to higher headquarters.

Please note that the line of communication between the point of origination of source documents and the data processing center may be ten feet or a thousand miles. In any event, source documents, per se, will be filed with the originator who will be accountable for their accuracy, and who will certify accuracy of paper tape or punch card inputs derived from them. (*Chart* 8). Data that enters the system will be purged of all duplication. No bit of data will enter more than once. By electronic manipulation these data will be consolidated, combined, divided, or summarized, and provided to all primary and secondary users in the format and on the time schedule required. Each segment of the functional organization, as a data source and connsumer, will make its contribution of input and receive reports required to do its job.

You ask, "What will the accountant's job be under this system?" Actually, he will be one of the most important members of the staff. In my opinion his job will be moved to a higher plane, generally, than it has been in the past.

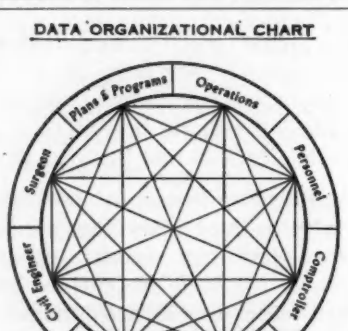
His first and most important job will be to assist in developing and installing the system. He must insure that it is accurate by policing the input system (garbage in, garbled garbage out). He must define and identify management reports, outputs to be produced, and analyze and interpret these reports into lines of action for his boss. He must develop, install, and enforce accountability and control procedures.

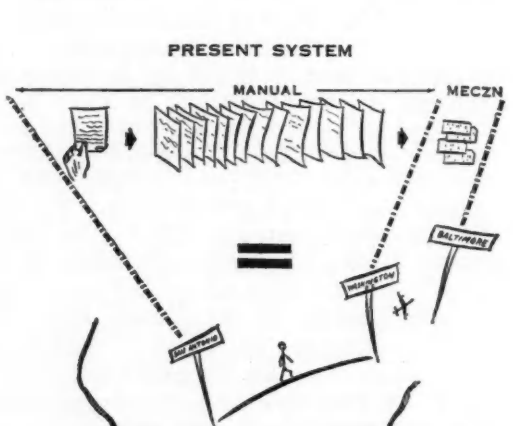
Most of all, the accountant will concentrate on systems and analysis. The important function of data interpretation, which he has never had time to do adequately in the past, will now become his specialization.

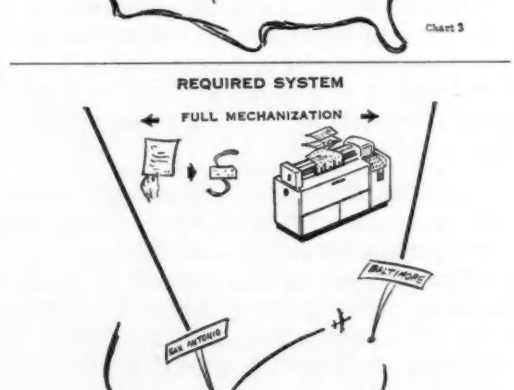
Progress is inevitable. In spite of all our mistakes and prejudices, our foot dragging and wrong turns, we somehow achieve, as a society and in the long run, a level of efficiency approximating the optimum. In the next few years, due to the great advantages which obviously will accrue from integrated data processing, source data automation, and central processing centers, our bosses will press hard for their implementation. Recognizing our traditional function as servants to management, and with full knowledge of the bosses' dependence upon us for a host of indispensable management tools, it is our responsibility — yes, our duty to assist in achieving these aims to the best of our ability.

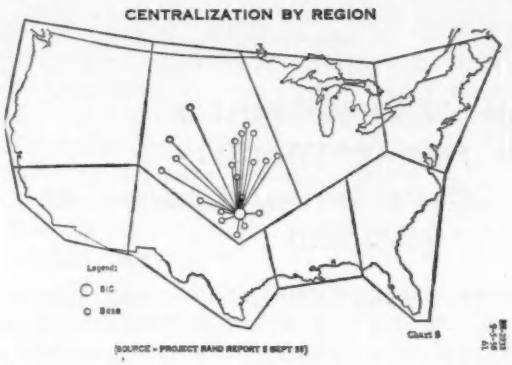
Unfortunately, some of us have a tendency to acquire a very pronounced systems fixation. We stand guard over our present systems, and staunchly oppose any move to penetrate into the inner sanctum. Such a reaction is not only inconsistent with our part in the scheme of things, but is an insult to the profession we represent. We are professionally oriented for primary attention to costs and profits. We owe it to the managers we serve not only to meet good, new innovations halfway, but to go out and meet them; to take a positive dynamic attitude toward them, and to press and press hard for their adoption.

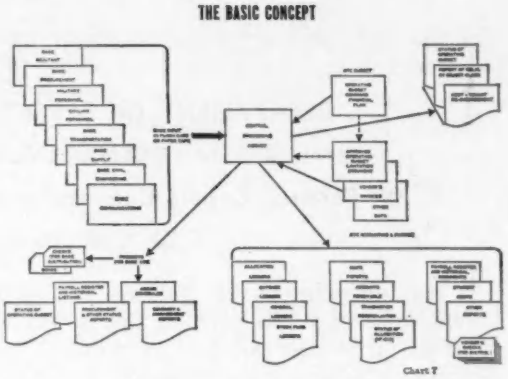
I urge all of you as professionals in the financial management field, to lift your heads and take a look around. You may find new electronic data processing systems bearing down on you that will completely change your professional life. Study, read, learn enough about these fascinating equipments and their potential to understand them. Then you will no longer be afraid or uncertain. Volunteer for systems development groups. Make a real contribution, and one day you will find that you are in that most enviable position; on the ground floor and a key man in something new and something big.

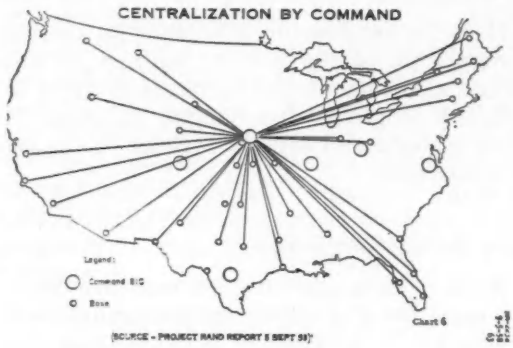


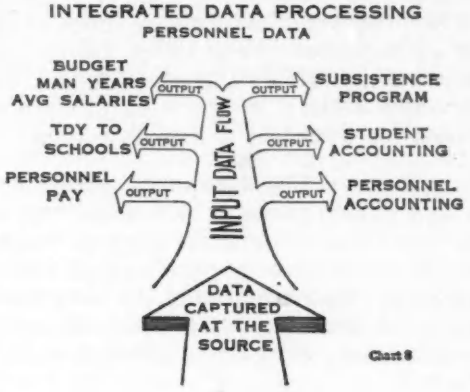












LETTER TO THE EDITOR:

Dear Ken:

Congratulations on the fine work as National Editor in producing the "Armed Forces Comptroller" and the ASMC Newsletter. These publications are worthy of the important National Association of Military Comptrollership as embodied in the American Society of Military Comptrollers. The development of the new format, including that eye-catching cover, has certainly been an outstanding event in the life of the publication, and much credit is to be given the National Editor for his creative efforts in achieving this improvement.

With Best Wishes for an increased circulation of the Journal — with an achievable goal of ten thousand.

Cordially,
Ernest L. Osborne

Editors Note: The National Editor of the "Armed Forces Comptroller" appreciates this letter received from Colonel Ernest L. Osborne, a Life Member of the Society. Ernest was the first National Secretary and the first Editor of "The Armed Forces Comptroller" under the reorganized Association, having its beginning in 1955. Colonel Osborne, at present, is practicing as a Management Counsellor in the field of Research and Development.

DEPARTMENT OF DEFENSE PROGRAM FOR IMPROVEMENT IN FINANCIAL MANAGEMENT FOR MILITARY CONSTRUCTION

H. W. Bordner, Deputy Comptroller Accounting, Office of Secretary of Defense, and
T. D. Culbertson, Vice President ASMC, OSD

The department of Defense has recently issued a second directive in the series which establish principles and policies required for improvement in financial management under Public Law 863 of 1956 and Title IV of the National Security Act. This directive concerns the area of appropriated funds which finance military construction (DOD Directive 7040.2); the first directive related to the area of appropriated funds for operation and maintenance.

Directive 7040.2 requires establishment of a time-phased program by each military department in terms of specific projects to complete the achievement of the goals established by the directive. After approval of this program by the Assistant Secretary of Defense (Comptroller), each military department is required to implement it.

This directive does not mark the beginning of improvements in financial management systems in this important area. The development of an integrated system of budgeting and accounting in the construction area began several years ago, but it was given its major impetus for the Department of Defense as a whole through the establishment of revised apportionment procedures of "Public Works" funds by DOD Directive 7150.3, dated May 29, 1957. That directive established forms of operating budgets on a cost basis to support both apportionment of funds for new programs and reapportionment of funds required to complete work started under prior years' programs.

It remained necessary, however, to require additional improvements with respect to: delineation of the scope of construction work which may properly be financed by appropriations for that purpose; simplification of budgetary control, including funding; and integration of budgeting and accounting procedures in one system.

While the directive, when issued, did not incorporate provisions for changing the presentation of construction programs and budgets in terms of weapon systems and support systems, it was prepared in sufficiently broad terms to encompass such an objective as the concept is developed.

It is the purpose of this paper to discuss the highlights of the system required in this area and also some of the problems involved in presenting programs and budgets in terms of weapon systems and support systems to the extent applicable.

Area of Military Construction

Military construction programs are those which cover the direct planning, financing, management, and acquisition of land and real property improvements, excluding only the construction of facilities for use in procurement and production of materiel and for research and development, when such facilities are authorized to be financed under the separate appropriations for those purposes. From a financial viewpoint, this is one of the areas of capital expenditures (or investments) for property which are required under the military programs of the Department of Defense.

Department of Defense Directive 7040.2 defines construction programs to include not only the purchase of land and the erection, installation, and assembly of new facilities, but it also includes additions, expansions, and extensions of existing facilities; the conversion to other purposes of existing facilities; the complete replacement of existing facilities; the equipment installed in and made part of all such facilities; and the related site preparation, excavation, filling and landscaping, or other land improvements. Construction does not include the alteration, maintenance or repairs of existing facilities; the cost of such work is an expense—not a capital expenditure. However, construction may include alteration or major rehabilitation of existing facilities in the activation of inactive installations. Construction does not include "collateral equipment"; that is, equipment which is

not installed in and made part of the real property facilities. Such equipment is acquired under programs for procurement and production, and these programs are financed under other appropriations for that specific purpose. However, for the sake of completeness, the initial budgets for military construction provide cost data for related collateral equipment in memorandum form.

All construction projects in excess of $25,000 each for the active forces and $10,000 each for the National Guard and Reserve Forces are required to be financed under the military construction appropriations. The $25,000 floor for the active forces conforms to a provision of Section 408 of Public Law 968 of 1956. This statutory requirement has not heretofore been interpreted uniformly nor consistently by the military departments; certain construction projects, as now defined, costing in excess of these limitations, have been financed heretofore under appropriations available for operation and maintenance.

Military construction programs fall into four categories, as follows:

1. Major construction
2. Minor construction
3. Planning
4. Supporting programs

There are separate appropriated funds in each military department for the Active Forces, the National Guard, and the Reserve Forces.

Congressional Authorization and Appropriation

Military construction programs are the subject of authorization in terms of cost under special acts, based upon reviews and hearings by the House and Senate Armed Services Committees. The appropriation bills are enacted after separate reviews and hearings by special subcommittees of the Appropriations Committees.

Appropriations are made upon a lump-sum, no-year basis for military construction programs of each military department, based upon *total estimated costs* of the projects approved for financing (not for that part of the costs estimated to be incurred in the budget year as in the case of civil-works appropriations). However, in the case of the major construction program of a military department, each separate authorizing act establishes a series of specific limitations on total cost of construction—one for each installation or for a department-wide category of like construction items, such as for a designated weapon system; hence, there are a number of cost limitations required to be observed in construction work at each installation (one for each applicable authorizing law). Certain flexibility is authorized in observance of these separate cost limitations provided the total amount of these limitations for a military department under any one law is not exceeded.

In the case of minor construction programs, there is a blanket legislative authorization for urgent emergency construction projects costing not in excess of $200,000 each (Section 408 of P. L. 968 of 1956). A lump-sum allowance for the minor construction program is included in each military construction appropriation. However, the legislative authorization requires the Department of Defense to follow certain procedures in authorizing the individual projects under this program. The Office of the Secretary of Defense is required to approve and authorize each project in excess of $50,000; the Office of the Secretary of a military department, each project between $25,000 and $50,000. Each individual project authorization establishes a cost limitation which may not be exceeded unless a revised authorization is obtained.

Cost-based Budgeting

For years, the new major construction programs have been presented annually to both the authorizing committees and appropriations committees in terms of the *total estimated costs of specific projects*. This is a "cost-based budget." It is recognized that the limitations on construction work in the legislative authorization acts are in terms of total costs. However, inasmuch as obligational authority is provided through the annual appropriation act for the total costs of the new program authorized, the budget in support of an appropriation request has generally, in the past, been called an "obligation budget." At least, it may be said that there is no problem here but semantics. It may be noted that the process of congressional authorization of construction programs is similar to the process in private business enterprises, wherein a corporation's board of directors authorizes new construction work to be performed in terms of toal cost.

Operating budgets in support of requests for approval by the Secretary of Defense and apportionment by the Bureau of the Budget are similarly on the basis of total costs with respect to all new construction projects to be started.

The operating budget, however, also includes a second part which consists of a comprehensive report upon the status of all projects previously authorized but not completed at the beginning of the fiscal year for the major construction program; this part supports a request for reapportionment of funds to finance such projects to completion. And in order to show the status with respect to observance of the many cost limitations in open authorizing acts, cost data are included under each limitation with respect to projects previously completed. The format of this report is set forth in DOD Directive 7150.3 (Form D). There is a series of these reports—one for each installation or other department-wide category used—followed by a department-wide summary.

For each installation, the cost estimate for each major construction project authorized but not completed at the beginning of the year is required to be updated in this report (current working estimate). The total cost of work in place and the total estimated cost to completion are shown for each project which was started but not finished.

The data are reported in essentially the following format:

Project Description	Public law ref.	Physical scope	Legislative authorization	Current working estimate	Cost incurred	Estimated cost to complete

These cost data, together with data on the cost of completed projects, are shown for each separate cost limitation in open authorizing acts and summarized for the installation as a whole in the following categories:

1. Work in progress during the preceding year (including projects completed during the year)
2. Funded (appropriated for) but not started
3. Approved (by Appropriations Committees) but not funded, if any
4. Additional requirements (authorized, but not funded)
5. Projects completed in prior years

Reapportionment of funds is made only for category 1.

Since reapportionment is made in terms of obligational requirements to complete (rather than cost to complete) it is necessary to reconcile (a) total costs incurred and obligations incurred, and (b) total estimated cost to complete and obligational requirements to complete—in both cases for category 1 projects only. These reconciliations are as follows for each installation (or department-wide category) as a whole:

	Current estimate working	Cost incurred	Estimated cost to complete
Total costs for category 1 projects	xx	xx	xx
Undistributed costs		+ xx	- xx
Unfunded costs	- xx	- xx	
Accrued expenditures	xx	xx	xx
Contracts and orders outstanding		+ xx	- xx
Obligations	xx	xx	xx

It will observed that undistributed costs and unfunded costs are shown for each installation only in total. Undistributed costs, if any, include the unamortized cost of construction equipment and the balance of the inventory of construction materials. Unfunded costs, if any, are those which are financed under other appropriated funds, but are included in the total costs of work-in-place. The undistributed costs are deducted from the total estimated cost to complete the projects, as the means of estimating accrued expenditures required to complete the program at each installation. And from the estimated accrued expenditures, there is further deducted the balance of contracts and orders outstanding for construction work at the respective installation as the means of estimating the additional obligational (or fund) requirements.

Any projects not started at the beginning of the year are required to be stated in the first part of the operating budget which supports requests for apportionment of funds for "new starts," notwithstanding this may represent "repeat" requests in some instances.

The department-wide data on total obligation requirements to complete work in progress added to the total current working estimates of projects funded but not started (category 2) provides the measure of the adjusted fund requirement under the major construction program at the beginning of the year. A comparison of this requirement with the unobligated balance of that program, as shown by the fund report at that date, provides information with respect to the excess amount of funds carried over, if any.

If the operating budget were to be presented completely on an "obligation basis," there would be the following changes in that part of the budget which covers the construction work previously authorized but not completed at the beginning of the year.

1) The amount obligated (total contracts awarded) would be shown for each project rather than the cost of work in place.

2) Undistributed costs (and the amount of related outstanding contracts and orders) would be artitrarily distributed to individual projects.

3) Unfunded costs would be omitted from consideration.

4) The cost to complete each project would become the "unobligated balance."

The overall installation totals in terms of obligations would be the same as in the case of the cost-based budget.

It is believed the cost-based budget is much to be preferred over the obligation budget for the following reasons:

1) The omission of cost data on work in place would be undesirable because it measures work progress from the standpoint of construction management. And at operating level such information is most important.

2) The substitution of obligation data for cost data for each project only tells what contractual actions have occurred in program execution. The existence of contract action by project can be reported simply by using a symbol.

3) Obligation data by project, if presented, could not be used to verify the accuracy of current working estimates, inasmuch as such estimates include allowances for costs not yet contracted for and unfunded costs (financed by other appropriations).

4) Cost limitations established by authorizing acts for major construction work should be observed in terms of total costs (including unfunded costs).

5) From a procedural standpoint it is difficult in manny instances to record obligations by individual projects, because any contract may cover a number of projects at one installation. Moreover, the arbitrary distribution to projects of costs of construction materials and equipment, in advannce of use, is cumbersome as well as undesirable from a management standpoint.

It is believed that the Armed Services and Appropriations Committees m i g h t find cost-based budgets for construction work previously authorized, or funded, to be useful in the same manner as the Department of Defense has found them to be useful from a management standpoint.

Budgetary Control, Including Funding

By means of apportionments, the Bureau of the Budget and the Office of the Secretary of Defense establish obligation limitations for each of the four basic kinds of construction programs under each construction appropriation, based upon approved operating budgets. Quarterly limitations are not imposed. Each apportionment action during the fiscal year is cumulative; that is, the additional obligation authority and limitations are combined with previous obligation authority and limitations.

Although the appropriations are continuing and do not expire for obligation at the end of the year for which they are made, reapportionment is required at the end of each year with respect to fund requirements to complete construction work which has been started but not completed. Such reapportionment has the result of withdrawing amounts apportioned for obligation in the previous year for major conscruction projects not started before the year-end, as well as revising the obligation authority and limitations for work started but uncompleted.

Apportionment action does not in itself establish obligation or cost limitations on indi-

vidual projects. Yet apportionments are made necessarily in contemplation of the legal requirement for each military department to observe the cost limitations established in the authorizing acts and administrative approvals of individual projects under the minor construction program.

In each military department the approved construction programs are centrally directed and controlled by a construction agency — the Army Corps of Engineers, the Navy Bureau of Yards and Docks, and the Air Force Directorate of Civil Engineering. These programs are administered generally through district offices of the Army Corps of Engineers and the Navy Bureau of Yards and Docks. Most of the construction work for the Department of the Air Force is performed by the Army Corps of Engineers, but some work is performed on a similar basis under the direction of the Navy Bureau of Yards and Docks.

Each construction agency directs construction work to be performed by the use of "construction directives" issued to the district construction offices either directly or indirectly (indirectly in the case of Air Force work). Construction directives list individual projects and estimated costs authorized for each.

DOD Directive 7040.2 requires the integration of programming, budgeting and funding for construction work, with the reduction of obligation and cost limitations to the minimum, consistent with the objective stated in Public Law 863, that no more than one allotment of funds should be given to an operating unit from each appropriated fund which finances activities for which it is responsible. In this area, the operating unit generally is a district office which is directly responsible for supervision, administration, and control of approved construction projects.

Integration of programing and budgeting in the execution of the construction program requires that construction directives shall also constitute operating budgets for the respective district offices responsible for performance. This means that construction directives which are issued by the program manager should be coordinated with the Office of the Comptroller at the level from which they are issued.

In the construction area, the operating budget is prepared by the operating agency and handed down to the operating unit; this is the reverse of the procedure in the area of operation-and-maintenance appropriations, where the operating unit prepares its initial operating budget and submits it for approval to the operating agency to which it is responsible.

It is necessary that the specific projects stated in the construction directives shall have been approved by the Office of the Secretary of Defense in connection with apportionment action in the case of major construction. It is also necessary that the cost estimates be within the limitations of the overall apportionment of funds and the individual cost limitations established by the authorizing legislation. Such cost limitations are specifically stated by law in the case of major construction programs and by individually approved projects in the case of urgent minor construction.

Integration of funding with program authorization requires that each district office be given an increase in its allotment from the appropriated fund for military construction equal to the total authorized costs of the projects (or changes in previously approved projects) covered by each construction directive. Funding total costs to be expended from the appropriated fund for construction also facilitates compliance with the mandate that no construction project should be commenced unless there are sufficient funds available to complete it as well as all other projects previously authorized. In addition to the requirement to record allotments granted, in the total amount of construction directives issued, as reductions of its fund allocations, it is also required that cumulative data on approved cost estimates stated in such directives will be maintained in each construction agency in terms which match legislative cost limitations, in order to assure compliance.

While it is necessary that each construction agency receive a funding authorization from headquarters of the military department in the form of an allocation of funds, w i t h i n the amount apportioned, as a basis for allotting funds to district offices, it is assumed that the past procedure will be followed in which military department headquarters allocates in full all funds which have been apportioned.

The only change required in present funding practice is the requirement for full funding by means of allotmens to district offices. While at one time there were many allotment limitations, corresponding to all the cost limitations placed by legislative and apportionment actions on a line-item basis, there is now required only

one allotment to a district office from each appropriated fund for military construction, with a subordinate obligation limitation for each of the four budget programs. It is, of course, true that the many cost limitations established by authorizing legislation are inconsistent in spirit with the objective of Public Law 863. However, it is necessary to observe whatever cost limitations Congress itself chooses to impose by law.

In order to carry out the mandate of Congress to observe the many specific cost limitations in authorizing acts, it is considered necessary that the construction agency continue to impose cost limitations upon district offices in those terms by means of the construction directives. It is also required that the district offices notify the construction agency and obtain their approval of any necessary revision in the cost estimate for each specific project by means of an amended construction directive. This is a somewhat awkward arrangement, but it is possible to live with it, because the requirement for approval of most revisions of cost estimates does not extend above the level of the construction agency.

Most construction work is performed on a contractual basis. However, some work is performed by military construction forces, mainly in overseas areas.

In contract administration it is necessary that the district offices and their individual project officers manage construction projects individually in terms of cost estimates. This means that the cost estimates should be revised, when required, on a timely basis, with higher level approval. It also means that the cost of performance of work must be continuously checked by use of cost reports of contractors in terms of specific features of construction of each project. These procedures are in effect, although improvements are desirable in the maintenance of more current working estimates.

In the case of construction work performed for another military department or another government agency, the standard procedure has been established that the work shall be performed on a reimbursable basis, except that in the case of Air Force work, the Army and Navy will continue to receive a suballocation of funds for separate administration in the same manner as their own allocated funds; this exception is made in view of the very large amount of work performed for the Air Force.

Reimbursable construction work would be authorized to be performed under a separate fifth construction program, for which funds would be made available to the performing construction agency by automatic additional apportionment and allotment, based upon the amounts of orders received from the respective ordering agencies.

Performance of work on a reimbursable basis is much simpler than the use by the performing agency of transfer appropriation accounts on the books of the Treasury or direct citations of funds of the ordering agency. Each of those procedures requires detailed accounting and reporting of transactions by the performing agency to the ordering agency. It is much simpler for the construction agency to bill the ordering agency, on a summary basis, for the cost of work performed, with reimbursement by check for the total amount billed.

Any reimbursable work performed under the planning programs or supporting programs would necessarily be performed under those programs, rather than the separate reimbursable construction program, in view of the undesirability of accounting for costs of such reimbursable services separately from the cost of work performed under the construction agency's own programs of the same character.

Integrated Accounting to Support Program and Budgetary Control

For many years, the Army Corps of Engineers had cost accounting for construction projects in support of program management, but the cost accounts were not directly used in budgetary control. Hence, for years the cost accounts were not made a part of the system of accounting for appropriated funds. In recent years, both the Army and Navy have moved to substitute cost accounting for obligation accounting in budgetary control of the costs of specific projects in relation to approved current cost estimates. In recognition of the effectiveness of such cost control, DOD Directive 7040.2 authorizes obligation accounting at each district office to be raised to the level of each of the authorized construction programs as a whole for each installation as a whole.

The Department of Defense requirement for a combined operating budget and cost report for construction work uncompleted at the end of each year, in support of a request for reapportionment of funds for the major con-

struction program (Form D), in turn, permitted the elimination of obligation accounting by project and the substitution of accounting for the cost of work in place. Directive 7040.2 makes this a standard procedure; it is not merely permissive.

Report Form D clearly established the basis for integration of cost and obligation accounting *for each installation.* Integration is illustrated by the following formula evidenced in the report structure.

Total costs of work in place
Less unfunded costs included above
Funded costs of work in place
Add undistributed costs
Total accrued expenditures
Add contracts and orders outstanding
Total obligations incurred

It will be noted that the above data are accounted for on a cumulative total basis for the current construction program, including accrued expenditures for previous years, consistent with the requirement for measuring total costs incurred for individual projects in relation to current working estimates—not just those accrued expenditures incurred in the current fiscal year. Similarly, obligations must be accounted for on a cumulative basis, including balances of contracts and orders placed in previous years, in relation to approved total costs.

Allotted funds must be accounted for primarily upon the accrual basis, consistent with the requirement for cost accounting for purposes of budgetary control, as provided by P. L. 863, and secondarily upon the obligation basis. This means it is necessary that the account for the "unobligated balance" *for each budget program* under the one district office allotment be charged with:

(a) Accrued expenditures for the period

(b) Net change in contracts and orders outstanding during the period:
Contracts and orders issued (+)
Liquidations of contracts and orders (-)

In consequence of the requirement to allot funds for the cumulative total cost of work covered by construction directives, the unobligated balance of each construction program of a district office at any time should be equal to the obligational requirement to complete all authorized work, based upon current working estimates.

It is necessary further to have a cost and obligation ledger for each program of a district office in order to provide the data required for cost control and reporting. This ledger should be arranged in the following order for the major construction program:

One section for each installation:

One group of cost account for work in progress for each legislative limitation--one cost account for each project (each subdivided by applicable construction categories)—each project cost account to record current working estimates as well as cost of work in place

One group of cost accounts for undistributed costs for the installation as a whole—one cost account for each kind of undistributed costs

One credit account for unfunded costs charged to the foregoing cost accounts (subdivided by other appropriated-fund accounts from which financed)

One debit account for contracts and orders outstanding for the installation as a whole.

In order to provide accounting control over the foregoing data, the cost and obligation ledger should be self-balancing by the addition of the following credit-balance accounts which provide a bridge to the fund accounts:

Total accrued expenditures—all installations

Total contracts and orders outstanding—all installations (all contracts and orders issued, less liquidations)

The foregoing accounts would include total prior years' balances carried over at July 1 as well as total transactions for the current year, as charged to the fund account, "unobligated balance of allotment." At the end of each fiscal year, the cost of projects completed during the year should be eliminated from the cost accounts for work in progress; an equal total amount should be eliminated from the balancing credit accounts, "accrued expenditures" and "unfunded costs."

The total cost of completed projects should be accumulated in a separate memorandum account in the cost ledger for each currently applicable legislative authorization for each installation for reporting in Form D.

A district office is not responsible for accounting for authorized construction work for which it has not received a construction directive; that is the responsibility of the construction agency.

The fund accounts of a district office should be kept in a general ledger maintained on a double-entry basis in a form which will match the fund reporting requirements (for each allotment). These accounts are required to be maintained on both the accrual and obligation bases of accounting. In the case of reimbursable work and services, anticipated reimbursements are required to be recorded in order to show total fund or budget resources.

The "balance - sheet" accounts — fund resources, unpaid obligations, and unobligated balances — should be maintained in the form required to produce a consolidated Section 1311 report for each appropriated fund as a whole.

The changes in fund balances (for each allotted fund) should be recorded in accounts subsidiary to (or part of) the "unobligated balance" accounts for each budget program in the order required for DD Form 1176 reports for the appropriated fund as a whole. Most of these data are required to be reported also for each budget program in DD Form 690.

A chart of appropriate general ledger accounts for a district office is presented at the end of this article. The general-ledger-account structure is substantially the same for all kinds of appropriated funds, with only minor variations to accomodate different circumstances, principally in the area of one-year appropriated funds.

The following principles are now established under both Directive 7040.1 and 7040.2: (1) there should be a separately balanced group of accounts in the general ledger for each appropriated fund (or subdivision thereof, including an allotment); (2) appropriated fund resources exclude property; (3) there should be separately balanced group of property accounts in the general ledger matching each principal fund under which they are currently financed; and (4) there should be an apropriate cost ledger subsidiary to each budget program for each appropriated-fund subdivision, which is subject to separate obligation control.

Improvements should be made to streamline and integrate the general-ledger accounts and cost-and-obligation-ledger accounts in order to comply with the objectives for accounting records stated in Directive 7040.2. These objectives include accuracy and timeliness of data recorded to meet report requirements, and efficiency and simplicity in producing reports based upon the records. It is axiomatic that the record structure should be in accord with the report structure which it is required to support.

Those interested in more information with respect to the features of the financial system in this area are referred to a publication of the Office of Assistant Secretary of Defense (Comptroller) entitled, "Financial and Accounting Procedures in the Area of Appropriations for Military Construction," Government Printing Office, 1960.

Weapon-system and Support-system Costs

Mission Costs

There is now the proposed objective of programing, budgeting, and accounting for all costs of investment in and operation of each major weapon system or suport system to the extent aplicable. The construction area present unique problems in the achievement of this objective.

The principal problem is identification of all construction costs related to a given system. This is because in many cases, a major weapon system or support system is supported at base level jointly with other weapon systems. While it is feasible to identify separately the construction costs of facilities which are directly required to operate a weapon system or support system and make them the subject of a separate construction project or projects at each base, the costs of construction of supporting facilities at the base which only indirectly support the system may not be readily determinable. In some cases this indirect support may be attributable exclusively to one system, in which case it may be treated separately for programing like a facility directly required for the system. In other cases, where there are joint benefits, it is impossible to divide the costs of the projects for each benefiting system or other activities, except upon a statistical basis.

The Armed Services Committees have long required a geographical type of presentation of cost estimates for construction in support of requests for legislative authorizations. Statutory cost limitations are made generally in terms of installation totals. However, this method has

been subject to exception. For example, a department-wide estimate was presented for construction directly required for a missile system at a number of Air Force bases, and a separate total cost limitation was made therefor, which is required to be observed separately in budgetary control. This exception was unavoidable because the base locations were not finally determined at the time. (This also necessitated much cruder cost estimating than normal.) This directive provides for planning and control of such department-wide authorizations upon essentially the same basis as each installation limitation in a public law.

For areas where it may not be considered to be desirable to us separate department-wide estimates for a given system as a whole, there are two possible solutions for consideration, depending upon the circumstances, as follows:

1. "Tag" each project at each installa- with a system identification, if it is required exclusively for that system. The cost estimates for such projects may be cross-accumulated by system on a department-wide basis.

2. For each project at each installation, state the percentage of cost estimated to benefit each identifiable system. These cost estimates may be fractionated for planning purposes by benefiting system, to the extent applicable, and cross-accumulated on a department-wide basis.

In each of the two above cases, it would be considered inappropriate to separately limit the costs applicable to one system; the accounting burden, as well as the financial inflexibility would be unbearable.

The development of cost data in programing and budgeting for construction in terms of major missions is also an objective to the greatest extent feasible. This goes beyond the area of costing weapon-systems and support systems. In some instances, the cost of a construction project related to a given system may fall cleanly into one mission category. In other cases a weapon system may be designed to serve multiple missions. And in some cases, it is simple to identify costs of specific construction work with a mission, but not with a system. Cross-identification and cross-classification of projects by mission also appears to be a coming requirement.

CHART OF GENERAL LEDGER ACCOUNTS FOR EACH ALLOTTED FUND FOR MILITARY CONSTRUCTION

A. Balance-Sheet Accounts

Fund resources (debit-balance accounts)

- Undisbursed Treasury balance
- Reimbursements earned receivable
- Refunds receivable
- Unfilled customers' orders
- Anticipated orders or other earnings for rest of year
- Travel advances
- Undistributed charges (net)

Unpaid obligations (credit-balance acounts)

- Accounts payable
- Accrued liabilities
- Contracts and orders outstanding

Unobligated balances (credit-balance accounts)

- Major construction program
- Minor construction program
- Planning program
- Reimbursable construction program

B. Temporary (nominal) Accounts

(Cumulative for fiscal year)

A separate group of accounts for each budget program

Sources of funds (credit balance accounts)

- Allotment received
- Reimbursements earned
- Increase in unfilled customers' orders
- Anticipated orders or other earnings for the rest of the year

Obligations incurred (debit-balance accounts)

- Accrued expenditures (net of refunds)
- Change in contracts and orders outstanding:
  - New contracts and orders issued
  - Liquidations of contracts and orders (cr.)

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21 SEPTEMBER THROUGH 22 SEPTEMBER, 1961

SOME OBSERVATIONS ON ACCRUED COST FUNCTIONAL BUDGETING AND ACCOUNTING IN AN AGENCY O & M PROGRAM

Captain R. R. Campbell, SC USN, Defense Atomic Support Agency

Our Congress makes yearly appropriations which control in varying degree the size and content of each Federal Program. In general the financial yardstick in the appropriation process is obligation of the public funds, although expenditures are important and are also considered. Notwithstanding legal and management interest in obligations, there is room for such refinements as are presently provided for in a program for "Improvement of Financial Management in the Federal Government" in which accrued costs become the focus of attention.

This collection of policies, most of which were stated in Public Law 863 of the 84th Congress, is intended to apply concepts that have proven useful in modern American business and so will make the Federal Government more "business-like." While the concepts are generally simple and good, applying them to the Federal Government is not so simple. For one thing they must fit the realities of original Legislative control of the Executive's funds. It must be recognized that Congress is capable of abridging some of the principles they urge on the Executive Branch, for example, by a legislated limitation within an appropriation for an "object" of expenditure. This requires management in the funding process all the way to the lowest allotment holder through what is really separate financing. In managing with accrued costs, Federal administrators must be bound by the attention Congress gives obligations and adjust their own attentions accordingly. The Executive Departments are not business establishments; they have their own reasons for being that are as ancient and pervasive as those of the entrepreneur.

Since some of the problems met by all agencies that undertake the program for Improvement of Financial Management in the Federal Government are of current interest, there are in the following paragraphs observations of these problems and factors contributing to such successes as have been realized in coping with them in this agency.

My comments apply only to Operation and Maintenance, and not to other programs that are financed in continuing appropriations; such as Procurement, Research, and Construction. With respect to the Agency itself, it will perhaps be sufficient to say that the mission is fairly well standardized among our field activities. In comparison to the military departments our O & M program is not a large one, although it includes most of the financial complexities that are usual in operation and maintenance activities.

The first exercise as we prepared to abandon the old method of budgeting and accounting by object classes and obligations was to develop a functional budget. This was undertaken by a committee effort in 1957. The problem was to describe the agency mission in a system of detailed classification of work that would serve for financial management and program direction equally. The classification had to suit our accounting capabilities, since each budget account would be a cost account when the work was actually done. It was no coincidence that the budget structure that was evolved showed kinship to the organization chart. The latter is a system of sorts for classification of work. One of the things that became apparent early was that every budget activity and cost account had to have a program manager at each level of organization. This is the glue that sticks the system together, and puts operating details of the financial job on the persons best fitted to cope with management of each of the many realms that the budget describes.

The fact that many of our field establishments in the various locations perform the same kind of work made it possible for the Operations part of the budget to be described fully in central instructions of the agency rather than leaving it to lower levels of administration to work out their own accounts. Maintenance was more easily standardized. A research building presents about the same maintenance problem and the grass in front mows the same as for a training building. The DOD has since published a standard list of Maintenance cost categories (DOD Directive 4150.9 of 1 March 1960) which was

substituted for our original accounts in the maintenance area.

In the several years since the first classification was made, there have been a number of changes. The first set of these was due to improvement from a second look at the facts in the light of a little bit of experience. However there have come along since a number of smaller changes each year as the work itself changes. The agency's mission is a living thing, and is not fixed even if the words in the Charter remain the same. We have found it desirable to postpone cost structure changes until the end of each Fiscal Year though it may be readily apparent that some are important at the moment. The reason for waiting is to preserve the record for each year intact. When changes become unavoidable between the ends of a fiscal year, they are made at some pain to the accountants by requiring that the costs involved be adjusted back to the beginning of the year in question.

The essential idea of accruing costs is that the costs are to be charged to the proper accounts in the time period to which the work belongs. Inventory bought in one period and used in another was the biggest exception to this under prior arrangements, followed by service contracts made in a period different from the one in which their benefits were applied. The accounting techniques to cope with recognizing costs in the period in which the acquired asset is applied are more complex than those which treat only with obligating and expending an appropriation. A system of general ledgers is required in which inventories are capitalized, along with many of the other things that are paid for out of funds available. Each one of the asset accounts in the general ledger must be supported by considerable detail, as by a system of financial accounting for inventory. As something goes out of stock or a service is used, the cost account benefiting is charged and the asset account is credited. On the other hand as things are bought the fund accounts are credited and appropriate charges are made to the asset accounts. The general ledgers provide for a "net worth" asset and liability statement at the various times that such a measurement is desired.

The effect of accruing costs is to make the annual Operation and Maintenance appropriation somewhat like a continuing appropriation. The funded assets on hand at the end of one year are carried over into the new year, and must be considered in the budget even though the prior year unobligated funds do not (they expire). This is one of the strengths of the new concept as compared with the old one. Squirreling away cash from the expiring annual appropriation into various "bought" assets is fully revealed and can be controlled.

The net acquisition of funded assets (including funded orders) plus the sum of costs recorded in the cost accounts must equal the obligations incurred in the fund accounts. That is, provided there is recognition of gains and losses in the funded asset accounts which have no direct fund consequences, as in the case of inventory acquired without cost, or losses in inventory.

At the present time obligations incurred remain the basis for control of Defense funds in the appropriation and apportionment process. This is reinforced by dire legal penalties of R. S. 3679 if authorizations at any point are exceeded. Here lies one of the greatest rubs in applying the system of accrued cost budgeting and accounting. Management attention becomes focussed on costs, but the cost accounts don't say whether the costs are being energized by a current allotment or one that was obligated last year. A manager who doesn't draw according to plan on assets funded in a prior period may exhaust his current allotment with no warning from the accounting system.

One antidote for this is not to abandon the object classification of costs, treating important objects in locally established fund control segmentations of the single O & M allotment. Only the four most important objects: pay, travel, contracts, and supplies, need to have this sentinel posted on the road by which trouble may come. The obligating documents pass through the fund control (object) account to which they belong, encumbering resources locally allotted to the respective fund control accounts, without regard to priority of the needs or the timing of their appearance. The rate at which the fund control accounts fill up gives a fairly sensitive reading on how long the current allotment will last.

In order to make use of this information it is necessary to classify the charges to the cost accounts and show them in the cost reports by the same four object groups. When an undesirable rate of obligation in one of the groups appears, it is possible to go to the current cost report and place a finger on the function or functions where the trouble lies. Since the functions go together with program direction, the individual Program Director who is off the track is

revealed for a talk with his Comptroller. This is seldom necessary, as the program directors learn how to read the cost reports themselves, as indeed they should.

The cost report that meets these needs is therefore a cost grid, which turns out to be readily adaptable to machine listing. The stub is the list of cost accounts. On the line for each cost account there are column figures for the important objects in which the costs are incurred, and also columns for overtime costs, for military pay costs, and total costs. The columns foot out to the total accrued costs in each object. These reconcile through respective funded assets, i.e., inventories and funded orders, to the obligations incurred in the fund control accounts. This system seems to work very well, and has been found to be easily within the capabilities of conventional accounting machines.

One of the facts of life in the Defense establishment is doing work for others. Generally this is supposed to be paid for by the agency benefited. As a result everybody's direct appropriation budget represents more nearly the cost of his particular mission functions. However, handling reimbursements complicates budgeting and accounting quite a bit. Total work is energized by the agency's own appropriations plus anticipation of earnings to be paid for from appropriations granted to others. The approach that appears to offer least difficulty is to budget and account for total costs, and leave reimbursements to be deducted en bloc from the total obligations incurred. This derives the obligations funded and required to be funded for the agency's own mission. The "sales" income represented by earned reimbursements in theory equals the cost of goods and services sold, however this is never proved. Sale prices are set on a variety of cost and statistical bases peculiar to each of the things sold. The accounting system is generally not called upon to cost out the actual goods or services solld except as units in each customer's account having an established value per unit. It would be unsupportable, for example, to try to account on a job basis for work on telephone system maintenance as between the benefit to mission functions and to reimbursable functions. An exception appears in minor construction work, where the job is costed in detail for direct labor and material, and a percentage is added for overhead.

As a military organization having logistics functions in the O & M program we have found it desirable to recognize military labor in our budgets and costs. The budget and cost accounts show total costs, including unfunded costs. The military pay appropriations of course are the source of pay for military components, and military spaces are fixed in a Table of Distribution. These unfunded costs are treated in somewhat the same way as are the reimbursable costs budgeted originally in other appropriations; that is, as a one-time reduction in deriving funded direct costs. However, the cost grid mentioned above keeps the unfunded costs separate so that they can be considered or not as the situation requires. Total cost, including military labor, is obviously the most significant measure of effort in functions such as Security where most of the force is military. It is also important in areas where there is a mix of military and funded cost which may vary from time to time.

The figures after the dollar sign are not the only useful facts in estimating and controlling costs. Work units may be even more useful, such as numbers of students to be trained, numbers of cubic feet to be heated, numbers of patients to be treated, etc. A better budget and management system can be made if there is a work measurement system operating in conjunction with cost accounting. For each budget and cost account there should be measured a typical unit of work, or performance factor. The performance factors can be programed into the future if planning resources are good enough. The unit cost of performance factors is a useful measure in comparing present results with one's own past record, and in comparing with peers. Cost targets can also be established and results against them weighed on the basis of actual performance. The next budget becomes authoritative when it is based on recorded unit costs and programed performance factors.

We have found that the unit cost of work must be derived from total cost rather than an included part of total cost such as funded cost. Otherwise any change in the mix of military labor and funded in-house or contract methods would change the unit cost of the factor and destroy its relation to the past.

In summary, a few years ago we were operating a financial system that budgeted for obligations incurred for pay, travel, printing, supplies, and all the rest, funding by allotments to each subordinate activity for each of these. Financial administration was a matter for the Budget Officer and his clerks. Nobody including the Budget Officer knew how much the functions in the agency's mission cost. Persons managing

the various functions did so without any regular knowledge or measures of cost, and necessarily did their managing only on the various units of interest without thinking very much about the cost.

Application of the principles in the program for Improvement of Financial Management in the Federal Government has changed this for the better. Each person responsible for a section of our mission now has cost knowledge of his past performance and his projections into the future. He knows, as do his superiors, how well we are doing in getting our money's worth. Our budgets are full of meaning, and operational decisions have an immediate connection with funds. The money common denominator "flows like mercury through creation's veins" affecting the multiple undertakings on all levels, as it should.

Bon Voyage !!

Chaplain (Colonel) Kenneth M. Sowers, Director of Administration and Management of the Office of the Chief of Chaplains U. S. Army is scheduled to become Staff Chaplain of Headquarters, Eighth United States Army and will supervise the activities of all Chaplains.

Chaplain Sowers was recently presented a degree of Doctor of Divinity at the Virginia Theological Seminary. Good Luck, Ken, we'll miss you.

INTERNAL AUDITING IN THE FEDERAL AVIATION AGENCY

History of the FAA

S. E. Blum, Chief, Audit Service Branch, Accounting Division, Office of Management Services

ABOUT THE AUTHOR

EDUCATION

B.B.A. Degree—City College of New York
Graduate Study — New York University Graduate School of Business Administration

EXPERIENCE

Public Accounting — 9 years (including 4 years as partner in small firm, New York State)
U.S. Army Audit Agency — 8 years (from 1956 - 1959 was Staff Manager, responsible for the Agency's professional training, research and career development programs)
Federal Aviation Agency — 1 year (Chief, Audit Service Branch, Office of Management Services)

PROFESSIONAL

CPA Certificate—State of New York
Member — Federal Government Accountants Ass'n; American Accounting Association

MILITARY SERVICE

World War II and Korean Emergency (5½ years — Army Engineers)

When Ex-President Eisenhower signed the Federal Aviation Act on August 23, 1958, the nation was provided for the first time an independent agency responsible for the total job of guarding safety in the air.

Creation of a Federal Aviation Agency (FAA) stemmed from an increasing awareness by the President and the Congress of the serious weaknesses in Federal supervision of civil aviation because of subordination of the function within Government, and the diffusion of responsibility among various agencies. Prompt passage of the Federal Aviation Act was spurred by the growing public concern over the hazards of flight in rapidly diminishing airspace, which were starkly emphasized by several tragic civil-military air crashes in the Spring of 1958.

The Federal Aviation Act of 1958 assigned to the Administrator of FAA all of the functions formerly vested in the Civil Aeronautics Administration of the Department of Commerce and the Airways Modernization Board, which agencies were discontinued. Additional authority was granted the Administrator to regulate the use of airspace and both the civilian and military aircraft navigating within it. The Act also transferred to FAA the authority formerly held by the Civil Aeronautics Board (CAB) to prescribe air traffic rules and regulations governing the flight of aircraft. The CAB was retained as a separate agency with remaining authority for the economic regulation of civil air carriers, the conduct of air-crash investigations, and serving as an appellate body for review of certain FAA actions affecting airman and air safety certificates.

On November 1, 1958, the President appointed Mr. Elwood R. Quesada as the Federal Aviation Agency's first Administrator. Mr. Quesada, who resigned his commission as a retired lieutenant general in the U. S. Air Force to accept the civilian post, had previously served as Chairman of the Airways Modernization Board and as Special Adviser to the President on aviation matters. On January 1, 1959, the FAA was a going business, with a complement of approximately 28,000 employees, the great majority of whom had been transferred from the CAA in one of the largest personnel shifts ever to be made in the Federal Government.

Mission and Organization

The Federal Aviation Agency is engaged in a wide range of activities geared to the diverse needs of civil aviation, as well as the requirements of national defense. The principal functions of the Agency include:

Fostering the development of civil aeronautics and air commerce in the United States and abroad
Management of the use of navigable airspace and the regulation of both civil and military operations in such airspace

Installation and operation of aids to air navigation and traffic control for civil and military aircraft
Conduct of research to develop facilities required to modernize the systems and devices used in assuring safety in aviation
Conduct of medical research relating to human factors affecting safety in civil aviation
Certification as to the competency of airmen and the airworthiness of aircraft
Development of standards and rules designed to promote safety in the air
Administration of Federal grants for airport construction
Operation and maintenance of the Federally-owned airports serving the National Capital area

The magnitude of the tasks assigned to FAA is evidenced by the resources authorized it by the Congress for FY 1961. Funds totalling $690,500,000 were appropriated, including provision for over 40,000 employees.

The basic organizational structure of FAA is shown in Chart 1. Responsibility for development and direction of the Agency's operating programs is vested by the Administrator in the Directors of the various Bureaus—Flight Standards, Air Traffic Management, Facilities and Materiel, Aviation Medicine, Research and Development, and National Capital Airports. Staff assistance and supporting services are provided the organization by the Heads of Washington Offices concerned with such matters as legal counsel, management services and personnel and training.

The field organization consists of six regions and the Aeronautical Center. At the regional level, field division chiefs are responsible for the supervision of one or another of the major programs conducted on a national scale, i.e., flight standards, air traffic management, facilities and materiel, and aviation medicine. These division chiefs report directly to the cognizant Headquarters Bureau Director, except for Regions 5 (Alaska) and 6 (Hawaii) where reporting is through the Regional Manager. Principal functions of the Aeronautical Center including major phases of technical training, heavy maintenance for all FAA aircrafts, and receipt, storage and issue of materiels for air navigation system, are supervised locally by activity chiefs, who receive direction from the appropriate Washington Office or Bureau. Regional Managers are responsible for coordinating the specialized field programs into a smoothly functioning whole, and directing the overall administrative support of these programs.

The Agency's present field organization embodies concepts which are well suited to the problems with which the Administrator has to cope. The significant advantages built into the organization include (1) greater speed in changing program emphasis after a decision has been reached; (2) redoubled attention to problem areas with each Bureau's program; (3) greater uniformity in carrying out programs nationwide; and (4) pinpointing of responsibility for achievements and shortcomings in the respective programs in the field.

During the first year of FAA's existence, considerable attention was given to defining the structure and responsibilities for financial management. An Agency Order was issued in December 1959 assigning the following functions to the Office of the Assistant Administrator for Management Services:

Budget and Fiscal Management
Accounting and Auditing
Management Analysis
Procurement and Materiel Policy
Statistics
Program Evaluation
Compliance and Inspection

The Office of Management Services was organized into eight divisions, for the performance of the above functions. Each division chief is responsible to the Assistant Administrator for developing and administering Agency-wide policies, systems and programs in their respective areas. The need for subdividing the broad accounting and auditing function into special segments was recognized by the establishment of three dependent branches in the Accounting Division for internal audit, accounting systems and central office accounting operations. Following this pattern, the field budgeting, accounting and auditing functions, formerly combined in a single Budget and Finance Division, were separated and established in April 1960 as divisions or services in the six regional offices and in the Aeronautical Center, Oklahoma City.

Development of the Auditing Function

Within the FAA there are three principal areas wherein an independent auditing function may be of service to management. These areas involve (1) the appraisals of Agency organizational components, programs and activities to

provide management officials with constructive comments and recommendations concerning the effectiveness with which financial and operating responsibilities are being performed; (2) furnishing those responsible for procurement operations with financial information and advice on contractors and contracts under which goods and services are supplied to the Agency; and (3) ascertaining the allowability of costs claimed by public agencies sponsoring airport improvement projects under the Federal-aid Airport Program (FAAP).

The development of a suitable framework of auditing concepts, organization and resources, to assure competent performance of the above categories of service on a systematic basis, has been given considerable attention by the Agency from the outset. The auditing capability available to FAA at its inception was limited to a small staff of capable professional auditors who had been transferred from the Civil Aeronautics Administration. Most of this group were employed in the Regional Budget and Finance Divisions and their assignments consisted mainly of audits of projects under the FAAP program. In addition, several supervisory auditors in the Washington Budget and Finance Office were responsible for the examination of concessionaires' records in connection with commercial operations conducted at the Washington National Airport, and the limited review of regional FAAP audit activities.

Although the talents of the audit staff taken over from the CAA could be put to immediate use in the new organization, it was recognized within the rapidly growing FAA that there was an urgent need to strengthen the independence of the auditing function and to broaden its capability to serve as a dependable managerial control. The establishment in January 1960 of an independent Headquarters Audit Service Branch within a Division of the Office of Management Services, the focal point in the organization of all matters pertaining to management policy, was an important step in this direction. A modest increase in the Headquarters audit staff was granted to provide for the necessary leadership in the formulation of broad-gauged internal auditing concepts and organization of an Agency-wide auditing program.

Our first goal in organizing the internal auditing program was to set forth the general plan through a statement of objectives, including a definition of the scope of audit responsibility. Since such a statement would, of course, depend on the views of management, we held several preliminary discussions with the Assistant Administrator for Management Services and members of his staff to ascertain the purview of the vitalized auditing function. These meetings also provided us with the opportunity to acquaint the Assistant Administrator with the broader concepts of professional internal auditing fostered by the Institute of Internal Auditors, which concepts we proposed to adopt as a basis for our statement of objectives.

As a result of these discussions, it was determined that internal auditing would be called upon to make an expanded type of contribution to FAA's management, by providing organized objective reviews of the many Agency operations having their basic roots in financial data. The broadened objectives of auditing were to be geared to meeting existing needs for ascertaining the extent of compliance at various organizational levels with policies and procedures and for constructive analysis of the Agency's internal operations. We accepted the formidable challenge presented to the auditing function by this expansion of its field of service and, in so doing, recognized three major obstacles that would have to be overcome on the long road ahead if the projected auditing program was to be of the greatest value to management:

1. Developing the ability of our internal auditors to effectively apply general auditing techhniques to activities of an operating nature which have no immediate accounting relationship.

2. Broadening our internal auditors knowledge of Agency operations and their capacity to view them in the proper perspective, as would management itself.

3. Maintaining close coordination with the other Agency elements providing professional assistance to management, such as the Management Analysis Division, to assure efficiency and cooperation in the performance of our respective responsibilities.

For the time being, however, our thinking and efforts were concentrated on the more immediate problems of preparing the statement of auditing objectives, charting the field auditing organization, and defining the responsibilities and duties of the various levels of auditor personnel. By June 1960, this preparatory work started to pay tangible dividends. A draft of the statement covering Agency auditing concepts and objectives was coordinated with all principal

staff and field offices and substantial agreement was obtained on all major points. Separate Field Audit Staffs were established in each of the six regional offices and at the Aeronautical Center to provide independent auditing services to the field elements, with policy direction, program guidance and technical assistance to be provided by the Headquarters Audit Service Branch. The professional auditors previously assigned to the former Budget and Finance Divisions were transferred intact as the cores of the new independent audit staffs, and Acting Chiefs designated on an interim basis from among their ranks. To promote a better understanding of the basis for our proposed auditing program among those who were likely to be affected by it, we then engaged in a wide variety of activities which included:

1. Participation in regular staff meetings to brief the Administrator and management officials at all levels on the principal features of our general plan.

2. Publication of an article on the purpose and scope of auditing service within FAA in Management Services Notes, an Agency periodical designed to transmit useful information to supervisory personnel.

3. Discussions with representatives of the General Accounting Office to advise them of the planned development of an effective internal auditing program and to arrange for appropriate coordination of the audit work to be performed by the GAO and FAA auditors.

4. Orientation of members of the Headquarters Personnel Office in the broadened range of duties, responsibilities, and qualifications to be associated with internal auditing positions under current concepts.

5. The first joint Conference of Agency Accounting and Auditing Officers to discuss changing financial management and organizational concepts and identify means whereby the accounting and auditing functions might make the fullest contribution to effective Agency Management.

Current Auditing Concepts, Objectives and Responsibilities

The policy statement establishing the objectives, responsibilities, and organization of the Agency's audit service function was released by top management on July 1, 1960, following the intensive preparations outlined above. This statement served to introduce a broader concept and scope of auditing service into the organization, highlight the potential benefits to be derived by managers at all levels, and to explain the relationship of audit to Agency operations.

The scope of auditing service to be furnished management is defined as including internal audits as well as external audits and related professional assistance in connection with contractual matters between the Agency and private enterprises and public agencies. Within FAA, both functions are assigned to one auditing organization to permit the more effective development and use of available auditor personnel and the furnishing of an integrated service to Agency officials concerned with the internal and external aspects of program operations.

The purview of internal auditing established in the basic policy statement, recognized the capabililty of the auditor in fields of service relating to activities of an operational nature, as well as those relating to accounting and financial matters. Internal auditing objectives in all fields are to be accomplished through the following processes:

1. Appraising the adequacy and effectiveness of accounting, financial and operating controls to determine whether appropriate measures have been adopted within the organization to protect and conserve its resources; check the accuracy and reliability of its financial data; promote operational efficiency and encourage adherence to precribed managerial policies.

2. Ascertaining the extent of compliance with and appraising performance under policies, plans and procedures established by management for the purpose of guiding and controlling operations, including determination that financial transactions and accounting processes are executed in accordance with applicable laws and governmental requirements.

3. Determining the degree of reliability of accounting, financial and other data developed with the Agency to assure management of the validity and accuracy of current reports.

4. Ascertaining the extent to which the Agency's assets are accounted for and resources protected from all unnecessary loss; and in this connection, bringing to management's attention costly practices, which develop out of defective methods or procedures, improper assignment or training of personnel, or wasteful use of property.

Audit services to be provided management officials in connection with their administration of activities conducted outside of the organization, under contracts, concessions, leases, and other legal arrangements, have the following three major objectives:

1. Furthering the achievement of prudent contracting and economical procurement by (a) the audit of contractors and making recommendations concerning the allowability of costs claimed under variable price contracts and extent of compliance with contractual provisions of a financial nature; and (b) furnishing technical advice and assistance in connection with cost analysis and related financial matters in the negotiation, repricing and settlement of contracts.

2. Assisting in the effective administration of the statutory FAAP Program by (a) the audit of public agencies' records to ascertain the eligibility and allowability of projects costs claimed, as a basis for determining the amount of Federal participation therein; and (b) advising operating officials on the extent of clearance by sponsors of special conditions stipulated in the Grant Agreements with the United States.

3. Reviewing business activities conducted by commercial firms under concessions at the Federally-owned airports, and other Agency installations, to determine that revenues accruing to the government are properly accounted for and paid.

The relationship of auditing to Agency operations is based on current professional concepts. Audit service, the scope of which is outlined above, is a staff or advisory function rather than a line or operating function. The FAA auditor does not make or direct changes in the procedures or operations of the activities audited. His aproach is to make independent analyses of existing policies, plans, procedures, and records, to report on conditions found, and to recommend action for the consideration of management officials.

Our auditing organization does not replace established lines of operating authority, nor does it eliminate the need for functional supervision and line inspections as may be necessary in the discharge of assigned responsibilities. Full responsibility is vested in operating officials for compliance with prescribed policies and procedures, for proper protection and use of the Agency's resources, and for appropriate action in the correction of problem areas, including those reported by the auditor.

It is generally recognized that independence is essential to the effectiveness of an internal auditing program. Within FAA, the concept of independence has two distinct aspects. From the standpoint of organizational status, the head of the audit service activity has ready access to and the full support of the Assistant Administrator for Management Services. Under this arrangement, internal auditing is coordinated as one of the major financial management functions by the highest ranking financial officer in the Agency; this assures a broad scope of activities, and adequate consideration of and effective action on audit findings and recommendations. From the standpoint of the auditor, independence is deemed to signify an unbiased judgment and objective consideration of all relevant facts as the determinants of his opinions. It implies an obligation on the auditor's part for a fair and complete presentation of the facts having a bearing on the results of his audit, which he owes to management and to those who may otherwise have a right to rely upon his audit report.

The Agency's auditing organization is designed to meet the needs of both the Headquarters and field levels of management for effective auditing services which will assist them in discharging their respective responsibilities. The auditing organization consists of the Headquarters Audit Service Branch and field audit staffs located at the six regional offices and the Aeronautical Center.

The Chief of the Headquarters Audit Service Branch is responsible for providing technical direction to the field staffs, and for planning and administering Agency-wide auditing policies, standards, programs and procedures. In addition, he represents top management in audit matters outside of the Agency, including coordination with the General Accounting Office. The principal means to be employed in the administration of the auditing program include the following:

1. Advance Planning of Audit Work: In advance of each fiscal year, an annual plan of the audit work to be performed will be prepared in cooperation with the Chiefs of the field staffs. This long-term plan is intended to provide an over-all view of the programs and activities to be audited and to establish priorities. After coordination with operating officials, the annual plan will serve as a basis for scheduling the timing of major internal audits and for projecting the utilization of auditor personnel.

2. Audit Manual: A manual of technical materials is to be developed by the Headquarters staff for the guidance of all Agency auditors in carrying out their work. It is intended that our audit manual reflect the policies and standards under which the auditing organization operates, and acquaint the auditor with the general objectives of our constructive and protective services. Internal audit materials will be primarily built around functional activities and will stress the major features of the work rather than detailed auditing procedures. Our aim is to stimulate independent thinking, which is the priceless ingredient of effective auditing.

3. Review and Coordination of Audit Activities: The Chief of the Headquarters Audit Service Branch and his staff exercise administrative control over the field audit activities to assure uniformity in program approaches, adherence to basic auditing plans and policies, and effective coordination of audit results with all interested Agency elements. These aspects of audit administration are accomplished through (1) written instructions or supervisory visits to the field to resolve policy and technical questions and clarify matters involving audit timing and coverage; and (2) review of audit schedules and progress reports submitted by the Chiefs of the field audit staffs to determine the degree to which planned audit service objectives are being achieved.

The Chiefs of the field audit staffs are responsible for organizing and directing the execution of all audit services in their assigned geographical areas. Within the broad framework of auditing policies and long range objectives established by the Headquarters Audit Service Branch, they carry out this responsibility by (1) developing and implementing an integrated schedule of contract and internal audit activities; (2) planning the scope of audits and personnel assignments; (3) controlling the audit work performed by their staff; and (4) coordinating audit findings and recommendations with management at the field level.

Audit Activities

Although we have been necessarily preoccupied with conceptual and organizational matters during the early stages of developing the Agency's auditing capability, we have not neglected the furnishing of tangible services to meet management's most pressing needs. Objective appraisals have been made and reports issued on various agency activities, including administration of the Research and Development Center, procurement practices, travel policies and procedures, and the financial closing of Federal-aid airport projects. The constructive comments and recommendations furnished by the auditor in these instances have served as a basis for significant actions by management officials to improve operations within their purview. Other internal audits are now underway, covering such areas as:

Obligational practices and fiscal controls (relating to the annual certification of unliquidated obligations required of the Agency).

Maintenance of program control records by operating activities (and their relationship to the official accounting system).

The Data Processing Central Program (Bureau of Research and Development).

Contract Administration (Bureau of National Capital Airports).

In addition to independent appraisals of the type referred to above, our auditing organization is also participating in special management surveys of operating activities which are being conducted on a "task force" basis by the Office of Management Services. The latter approach is employed by the Assistant Administrator in connection with situations where concurrent, closely coordinated coverage is desired of his Budget, Materiel Policy, Management Analysis, and Internal Audit elements.

The contracting officers in the various bureaus have been alert to recognize the place of the auditor on the procurement team, together with the engineer and the attorney. They have called on us to furnish advisory reports and other professional services relating to a wide range of activities, such as:

Establishment of contract overhead rates.

Analysis of costs in contractors' pricing proposals.

Evaluation of contractors' claims for contract price adjustments.

Review of concessionaire operations at Washington National Airport.

Audit of contractors' costs claimed under CPFF contracts.

In those instances where FAA cost-type or variable price contracts are negotiated with contractors who are also performing under Department of Defense contracts, our practice is to request audit service of the cognizant military

audit agency. Based on the current listing of contractors included in the coordinated auditing program of the Department of Defense, we transmit contracts and related documents to either the Army Audit Agency, Air Force Auditor General's Office, or the Navy Comptroller's Office, and arrange for the performance of audits at contractor's plants and the submission of periodic audit reports covering findings and recommendations of use to FAA's contracting officers. With the cooperation of the military audit agencies we have developed a set of simplified standard procedures which provide for a uniform approach to the examination of and reporting on FAA contractors' costs claimed under CPFF contracts. Implementation of these procedures has resulted in improved contract administration and more rapid payment of contractors' billings. Liaison is maintained with the field audit offices of the military agencies to keep informed as to the progress of work on FAA contracts and to coordinate special requests for audit assistance initiated by FAA's contracting officers.

During the year 1960, a total of over 350 audit reports covering costs and other financial aspects of FAAP projects were submitted by our field audit staff to regional officials to assist them in the administration of the airports program. Current legislation authorizes a program of grants-in-aid to State and local governments for construction of a national system of airports to meet the requirements of civil aviation. The program at the present time amounts to $63 million per year and involves in excess of 1,000 projects in being or under consideration. The continuing volume of FAAP projects to be audited and the importance of the audit report in determining the amount of Federal participation in the costs of projects have served to focus our attention on the nature of the verification and reporting methods traditionally used by our field auditors. We are now engaged in a review of existing project auditing instructions and practices to determine whether (1) appropriate recognition is being given to test-checks and modern sampling techniques; and (2) audit reports furnish information of the kind in which management is interested and which they can use with the minimum effort.

Planning of Audit Work

Our auditing organization has now reached the stage of maturity that permits the visualizing and formulating of the long-range plans upon which a systematic internal auditing program can be based. The principal purposes of such planning are (1) to establish the scope and pattern of operations required to achieve the Agency's audit service objectives; and (2) to provide a sound basis for predicting and securing through the Agency's budget process the resources needed to carry out the projected auditing program.

We are presently engaged in building the initial framework for Agency-wide internal audit operations in Fiscal Years 1962 and 1963. Our approach involves the following processes:

1. Identification of Agency activities that appear to warrant, from management's viewpoint, periodic objective evaluation.

2. Determination of priorities in audit coverage, and of the desired frequency of audits.

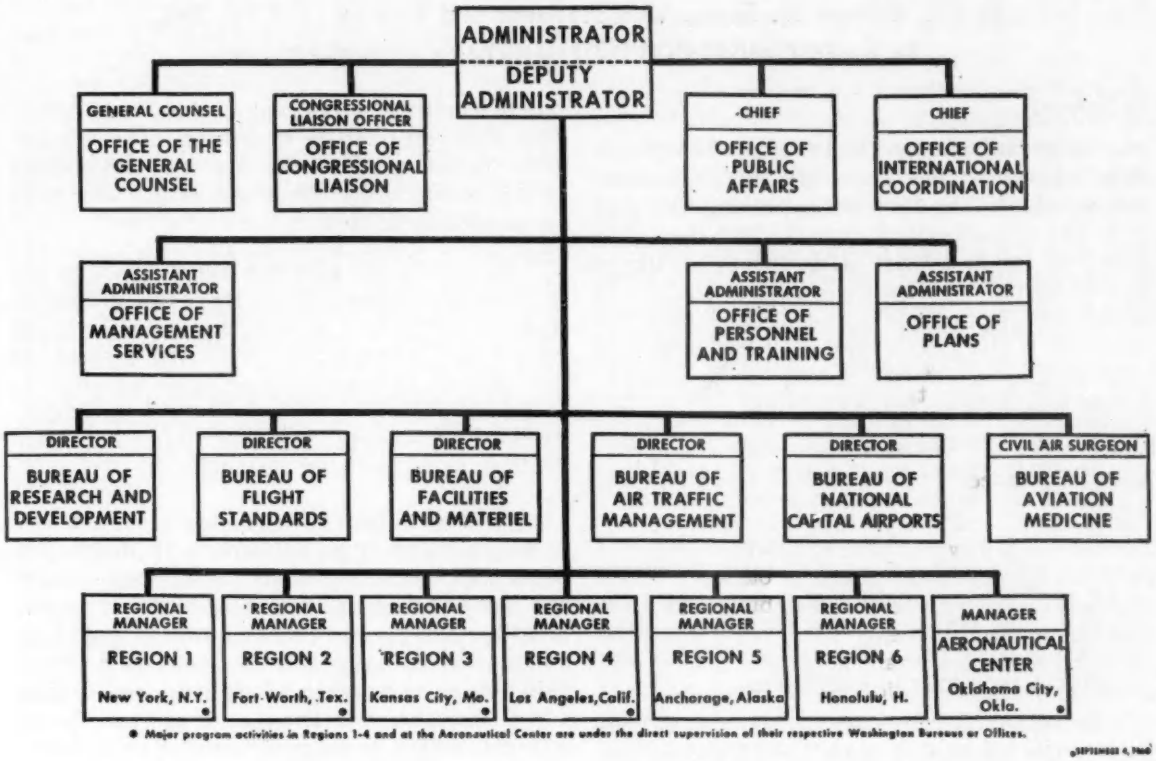
3. General definition of the proposed scope of each type of audit.

4. Discussions with management officials to gain acceptance for the proposed program.

5. Coordination of projected audit activities with all interested staff offices.

Upon completion of the above steps, we aim to prepare for Agency-wide implementation a firm schedule of internal audits for FY 1962, to assure the most effective use of available auditor personnel; and a proposed audit program for FY 1963 to serve as the basis for our budget estimate and as justification for the additional resources to be required in that year.

FEDERAL AVIATION AGENCY



* Major program activities in Regions 1-4 and at the Aeronautical Center are under the direct supervision of their respective Washington Bureaus or Offices.

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"THE CURRENT REVOLUTION IN BUSINESS MANAGEMENT METHODS"

By Dr. William W. Eaton, Vice President and Director, C-E-I-R, INC.

To AMERICAN SOCIETY OF MILITARY COMPTROLLERS

Background

Technical advances in the field of electronic data processing have been very rapid. Tremendous progress has been made during the past 12 to 15 years, especially since the first steps were taken on the first UNIVAC at the University of Pennsylvania. No other innovation in the history of technical equipment has advanced so fast. For example, if the aircraft industry had advanced with similar speed, the dating of its developments would have been as follows:

In 1910 - Planes fly at 100 miles per hour
In 1911 - Planes fly at 500 miles per hour
In 1912 - Planes attain supersonic speeds.

This is truly the Age of Science, which fact is shown by this situation: Of all the Scientists in all the recorded history of the human race, over 70% are still alive. We are moving very, very fast in three fields, Electronics, Plastics and Metallurgy-especially in electronics.

The speed of computers in 1960 was 5 times that of the machine 2 years ago. The cost per computation was one-half of the machines two years old. In 1962 it is expected that the speed of computation will be lifted fivefold as compared with the present speeds. And the cost per computation will be a third or a quarter of the present cost per computation. We are moving fast!

Computers will shortly be capable of performing millions of calculations per second. It is reasonable to say that the research and development in the field of EDPS since 1948 has produced more breakthrough advances than in any other field of technical improvement at any other time in history.

Dr. Herbert W. Robinson, well-known economist and President of C-E-I-R, estimates that within the next 10 years, about 30 billion dollars will be spent annually in producers' durable goods, or capital equipment. He further estimates that 6 billions of this amount will be spent on electronic and automation equipment, or about 20% of the total. There will be many new tools electronically controlled. But the largest expansion will be in the large organizations where electronic processing of data is of particular importance. The Comptrollers in the Defense Department will have a very large share of this development. They will have a very large responsibility in it.

In connection with the use of EDPS in the large organizations such as those in the Department of Defense, I should like to indicate one aspect that is frequently overlooked, despite the fact that we have experienced large increases in EDPS in accounting routines - Payrolling, Cost Accounting, Account Keeping, Statement preparation, and Inventroy Control.

However, I find that we sometimes overlook areas where really significant developments are occurring which are made possible because of the reduced cost in processing large quantities of data. Cost per computation now is on the order of one ten thousandth of a cent each. From this fact alone arises a whole new spectrum of use. I should like in the rest of my talk before you, gentlemen, to mention some of these areas.

There has been no period in history where the habits of human life has been changed so fundamentally as during our own lives. The very recent developments of radio, of television, of EDPS, have changed our way of life perhaps more than we can realize now.

We are now facing even more drastic changes by reason of the tremendous reduction in the unit cost of the processing of documents and the making of computations. Now a typical computing job can be done for a few pennies that would have cost $10,000 to do, say, five years ago on a desk calculator. We at C-E-I-R have a lot of this kind of business.

We face a real revolution in this connection. I will mention several of these areas.

Linear Programming

This is the new name of the old technique of optimization. What is the best way to do this job? What is the best way to accomplish this

mission? What is the cheapest way to make this shipment? The idea is old.

To me the old name is a better description of what is done than is the new name. But there are vast differences between the procedures of the old idea and the new ones. We have the fantastic speeds of the modern electronic giants to do the computations where before we had only the desk calculator.

Here is a simple illustration of linear programming. What is the shortest distance and the cheapest way to go from the Naval Weapons Plant to 16th Street and Military Road?

When you look into a question of this sort you see that there are many routes. Patterns of traffic are involved; also, the time of the day; the means of your locomotion. If you walk there is one best way. If you drive a two ton truck there is usually only one "best way". To pick out the one best route you will need an accurate comparison of all the many thousands of possible ways.

Then you can select the one that will make effort and cost a minimum. The method of choice has hereto always been somewhat intuitive - a method of picking based largely on human judgment, even on human sentiments. Time and the cost of labor have limited a thorough comparison of all the many possibilities involved.

A computer, however, can make all the comparisons, rapidly and accurately. These are appraised objectively in terms of yes and no compliances with the criteria established. Guessing and by-goshing of one person is replaced by real comparisons that have in them the merit of producing the one best way to make this simple journey or this one shipment at a minimum in effort and cost.

The differences between the "one best way" and an "intuitive good way" are not too important in an over-simplified case of this kind, particularly if there are only one or two movements involved. But suppose the problem was to move 100,000 packages from the Naval Weapons Plant to an air base in the Middle East. Here the process of computer optimization becomes complicated. If the choices are many, if the criteria for decision are also in large volume, then the choosing becomes a matter of test-and-compare which must include every possibility. The machine can work so fast that a tremendous volume of computations is possible at a low cost. Thus the economies of "the one best way" can be obtained in each situation. The computer can systematically make up the combinations and permutations with speeds that no human brain can match. And the machine is tireless, working day and night without stopping. No human brain could hold the volume of fixed and variable information or be sufficiently tireless to accomplish the computations required in this kind of management analysis.

I will give another illustration in the business of refining crude oil in the petroleum industry. The benefits of optimization here have been enormous. In one company the profits on optimization can be as high as $100,000 a day.

The complications of refining are such that benefits can only be developed with the aid of computers having the present fantastic speeds of operation. There are many variables-temperature, pressure, blends, price of each input item, price of each possible output item. The input data must be put into the computer, which then can work out the most economical and highest profit combination of finished outputs.

Another illustration is this: What is the most efficient way of handling storage of materials or finished products and making transfers from place to place? How can the several elements of bulk, price, packaging, space, accessibility, minimum quantities needed, transportation rates and time - all be combined to arrive at the most desirable combination, all things considered. Only the computer can economically answer such questions so as to obtain the lowest possible unit costs together with desired availability.

In private business, managers can pay well for the benefits of optimization. They can see and measure the direct effect upon the Profit and Loss Statement.

When electronic data processing is mentioned today among knowledgeable persons, I think such people often naturally tend to think of the mechanical preparation of payrolls, the printing of pay checks - in short, they think of accounting processes which have been mechanized and put on magnetic tapes.

When the term automation is mentioned, such people will usually think of improved control over the processing of manufactured products through mechanical movements, chemical processes and reshapings.

Both of these aspects of electronic control of business and production operations are important. But I wish in the rest of my talk to you to-

day to emphasize something quite different and which in my mind is often far more significant than this so-called "business data processing".

Management and Electronics

I have in mind several management uses of electronic data processing equipment that I should like to talk about briefly in the time that I have before you today.

Production Scheduling

The job shop has always been faced with the problem of organizing its factory operations in such a way that completion dates could be established in advance of the beginning of work. Where there are many kinds of jobs being worked upon at the same time there is the requirement for accurate work scheduling if production chaos is to be avoided.

A similar situation obtains with maintenance crews. Such crews may have fifty diverse crafts represented, such as cement men, carpenters, window washers, etc. The pattern of the work must be set for each building to be maintained or repaired, for each piece of machinery, for each ground area ... What are the priorities? Where shall the men go first? And when? How long will each man or crew be on each job? What materials are needed? Where shall such materials be delivered? When? In what quantities? These and similar questions by the dozen must be answered before a maintenance and repair program can be organized in the most efficient and economical manner possible. Otherwise the costs get out of control, the men waste not only their time but also materials. Without scheduling, this kind of work cannot long be accomplished within reasonable cost boundaries.

After proper mathematical analysis, the computer is peculiarly adapted for the preparation and print-out of detailed scheduling that takes into its purview all available time by crafts, the time to use each craft, the use of materials, the cost limits, and all other relevant factors.

Some factors cannot be identified in advance: for example, the possibility of a labor strike, or a shortage of materials. In such situations there is no substitute for human judgment. Accordingly, the electronic computer should always be recognized for what it is, namely an *aid* to judgment and not a *substitute* for human judgment.

Storage and Retrieval of Information

It has been estimated that about 10% of our effort is wasted in developing information that we already have, but cannot find. This is especially true in military administration.

There are several aspects of the storage and retrieval phase of computer usage. Inventory control is one of these. The electronic system provides a storage and inventory record and rapid access to individual items. The system also provides for rapid updating of the inventory record. But more than that, the system allows for a current analysis of the inventory record as against maximum and minimum quantities on hand, the determination of the order point of each commodity. It can be used to develop turnover information. Out of this capability in many installations are developed large economies in the use of inventory materials. The machine can answer the question: What are the optimum balances thatt we should carry on hand to meet production requirements and not run large risks of production delays due to material shortages? These computations can be readily done on the basis of mathematical models describing the situation with respect to each commodity. In large inventories the matter of quick and precise identification of items is a problem. If the factory or a combat unit needs a left hand screw of a certain size it is as important not to issue a right hand screw as it is to provide the right kind of threads and sizes. If the screw or other item cannot be found immediately, time is lost and matters of importance may be disorganized. Customers may be lost. Battles could be lost, even when the predominance of resources is on our side.

Management Gaming

War gaming is an old technique practiced since ancient times to give experience to the military leaders in troop command, and in the organization and use of troops and materials as well as terrain resources. Such games are now played with the computers as well as in the field under mock combat conditions.

Business management gaming is also being used now. Assumed situations are worked out to give the ultimate effect upon Profit and Loss. People are assumed to be hired. New capital is assumed. Production is theoretically established. And products are sold under assumed price conditions. The net effects are computed with due importance being given to competitive con-

ditions. The leadership capacities of the organizations are thus tested and talents developed. Compiete statements covering a five year history by quarters are not unusual in management gaming, the whole process requiring but a few hours.

Operations Research

In Operations Research we find the "experts" who work with complicated mathematical models of real-life situations. The advent of high-speed computers has made this formerly abstruse science blossom into a really valuable technique for business.

Decision Making

The computer is used to work out, on the basis of mathematical models, the complex interaction of factors to determine hypothetically the best combinations for the lowest cost and the best timing for a business problem or a series of problems.

Reliability and Quality Control

Here we have an extraordinary important use of the computer to effect statistically precise controls on quality of a manufacturer's output. Also, tests on reliability can be accurately measured against ideal expectations.

Experiment Design and Analysis

An example of this use of the computer is provided by the Proving Grounds such as the Navy has at Dahlgren, Virginia. It is desirable in such a situation to have the tests of guns and missiles well set up and organized to produce the greatest amount of significant data, with the lowest possible cost and the minimum use of equipment. The design of the testing methods is itself tested on the computers before the materials are put to the test on the proving grounds. Masses of data are digested. The computer compares the possibilities and extracts the significance of the tests even before they are made. The actual tests accordingly are conducted with maximum possible efficiency.

Military Command and Control Systems

The opposing generals of Civil War days had available approximately the same means of directing combat of the opposing troops. Typically the battles were fought on low ground so that the Generals might observe from higher points as they sat on their horses and viewed operations with their binoculars. Location of troops not within the vision was a matter of conjecture. Luck and accidents often determined the victor.

But today's commander sits in a command post, usually far in the rear. Battle operations now comprise not only the forces in combat but also numerous adjunctives such as supply lines, reserve forces, reserve armor, surprise facilities and maneuvers. I need not dwell upon the complicated machinery of today's battles.

However, it is obvious that the organization for actual battles is now a complicated business. Computers are at the heart of this business. It is the job of the computers and data processors to get the data in, to store it, to analyze it, to print out the effect of commands and to display the actual combat status.

The side that can keep even slightly ahead of the other side now has a great advantage. Timing now is of the very essence of success, for today's wars are fast with the unexpected kind of events frequently being of determinative importance.

"Real-time" data processing is very important in military command situations. A few seconds may mean protection from and defense against damaging attack, as by ICBM's. The pressure is on for fast and yet faster computers. Speed is the sine qua non today of military success.

Conclusion

In closing I would like to emphasize that in today's business world, the ability to stay ahead is needed, just to survive. The pressure is on. Accordingly, we will make more and more use of the computer for management purposes.

As to the impact of the accelerating replacement of human effort by the machines that can produce things, make judgments and do controlling work, I have a feeling, based on past experience, that the increasing use of the automatic services of our economy will generate jobs more than sufficient in number to take care of the employment problem.

There is ample factual support for this. For example, in the telephone field, it has been reliably estimated that the present services of the

telephone could not be provided with the old manual plug board techniques except by the use of three-quarters of the entire female population of the country. Obviously we would not have the present services under these circumstances. As it is, more workers are now employed than ever before to provide the modern dial telephone services we enjoy today.

Many jobs are being cut out. But other jobs are being set up. There are many individual hardship cases. But history shows that individual hardship has never stopped mechanical progress. It takes time to make these sweeping changes in the organization of the economy. It requires vast sums of money, and this fact in itself is a limiting factor to the speed of the changes.

The article "TO BUY OR RENT" was reprinted in the June 1961 Journal by permission of the Navy Comptroller Review, Marion Stewart, Editor. The Editorial Staff regrets the omission.

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